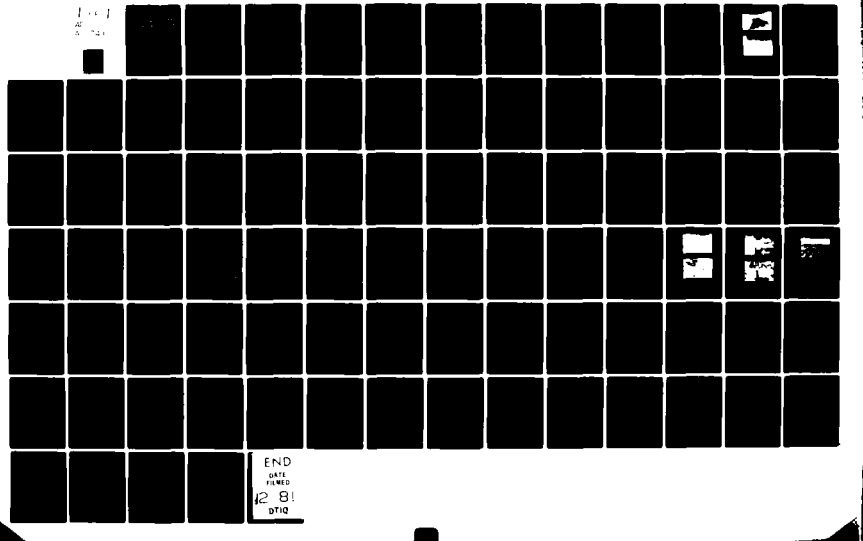
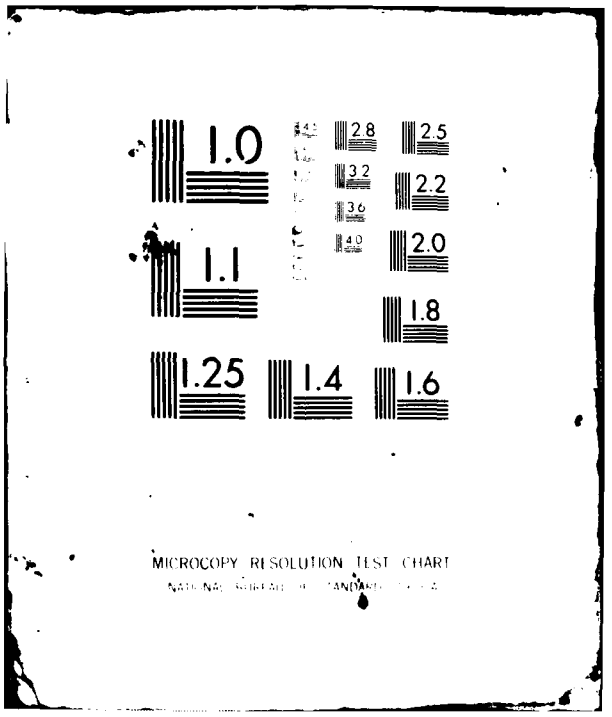
AD-A107 416 SCHNABEL ENGINEERING ASSOCIATES RICHMOND VA F/G 13/13
NATIONAL DAM SAFETY PROGRAM. LEATHERWOOD CREEK NUMBER 5 (INVENT--ETC(U)
JUL 81 C S ANDERSON, J G STARR, R E MARTIN DACW65-81-D-0020

UNCLASSIFIED NL



END
DATE FILMED
12 81
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART

ROANOKE RIVER BASIN

Name Of Dam: LEATHERWOOD CREEK NO. 5

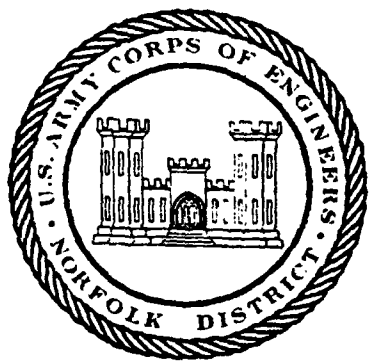
Location: HENRY COUNTY, VIRGINIA

Inventory Number: VA. NO. 08902

1

LEVEL II

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

JUNE 1981

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: VA 08902	2. GOVT ACCESSION NO.: AD-A104 446
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE *(and Subtitle)*: Phase I Inspection Report National Dam Safety Program Leatherwood Creek No. 5 Henry County, VA	5. TYPE OF REPORT & PERIOD COVERED: (9) Final Rept.
	6. PERFORMING ORG. REPORT NUMBER:
7. AUTHOR(s): Schnabel Engineering Associates, P. C. J. K. Timmons and Asspcoates, Inc.	8. CONTRACT OR GRANT NUMBER(s): (15) DACW-65-81-D-0020
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Schnabel Engineering Associates, P. C. J. K. Timmons and Associates, Inc.	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (12) 95
11. CONTROLLING OFFICE NAME AND ADDRESS: U. S. Army Engineer District, Norfolk 803 Front St., Norfolk, VA 23510	12. REPORT DATE: (11) July 1981
	13. NUMBER OF PAGES:
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*: (10) Carl S. /Anderson, Jr. Jack G. /Starr Ray E. /Martin	15. SECURITY CLASS. *(of this report)*: Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE:

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

(6) National Dam Safety Program. Leatherwood Creek Number 5 (Inventory Number VA 08902), Roanoke River Basin, Henry County, Virginia. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

(See Reverse Side)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

394014 slb

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Inspection is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

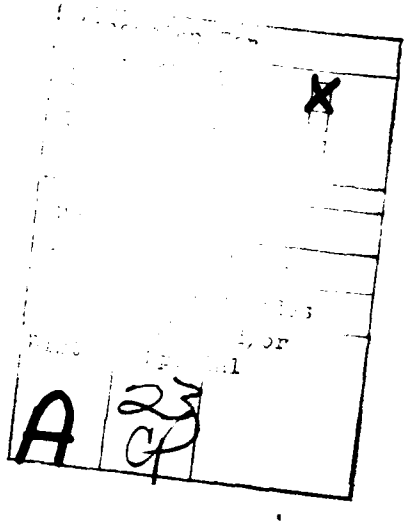
Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

ROANOKE RIVER BASIN

NAME OF DAM: LEATHERWOOD CREEK NO. 5
LOCATION: HENRY COUNTY, VIRGINIA
INVENTORY NUMBER: VA. NO. 08902

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



PREPARED FOR
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA

BY

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS AND ASSOCIATES, INC.

TABLE OF CONTENTS

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam:	Leatherwood Creek No. 5 Dam
State:	Virginia
Location:	Henry County
USGS Quad Sheet:	Axton
Coordinates:	Lat 36° 43.9' Long 79° 43.4'
Stream:	Leatherwood Creek
Date of Inspection:	June 30, 1981

Leatherwood Creek No. 5 Dam is a zoned earthfill structure about 510 ft long and 57.2 ft high. The principal spillway consists of a reinforced concrete riser and a 36 inch diameter concrete outlet pipe which extends through the structure. An earth emergency spillway is located 375 ft right of the right abutment with a 200 ft wide bottom and 3H:1V side slopes. The structure is classified intermediate in size and is assigned a significant hazard classification. The dam is located on Leatherwood Creek approximately 1.5 miles east of Leatherwood, Virginia. The dam is used for irrigation, flood control and recreational purposes, and is owned and maintained by Mr. Billy B. Lawrence and Mr. Coleman Lawrence.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the appropriate Spillway Design Flood (SDF) is the ½ PMF. The spillways will pass 30 percent of the Probable Maximum Flood (PMF) or 60 percent of the SDF without overtopping the dam. During the SDF, the dam will be overtopped for a period of 5.5 hours up to a maximum of 1.8 feet and reach a maximum velocity of 5.9 fps. Flows overtopping the dam during the SDF are not considered

detrimental to the embankment with respect to erosion. The spillway is judged inadequate, but not seriously inadequate.

The visual inspection did not reveal any problems which would require immediate attention. A summary of the design stability analyses for the upstream slope under drawdown conditions and the downstream slope under steady seepage conditions were reviewed and found to be acceptable.

It is recommended that the owner implement an emergency action plan to warn the downstream dwellings of any dangers which may be imminent.

The following routine maintenance and observation functions should be initiated within the next twelve months:

The grass and weeds on the dam embankment and in the emergency spillway should be cut at least once a year and preferably twice a year. Maintenance is recommended in the early summer and fall. Existing trees on the dam should be cut to the ground. All cut trees should be removed from the embankment.

The eroded area along the left downstream abutment-slope contact should be stabilized and reseeded. Rutted areas observed on the embankment crest should be backfilled and reseeded. Reseeding is also recommended in the eroded areas present in the emergency spillway. Areas of displaced riprap along the right downstream abutment-slope contact should be monitored during maintenance operations. If erosion develops, it is recommended that the missing riprap be replaced.

A staff gage should be installed to monitor water levels.

SCHNABEL ENGINEERING ASSOCIATES, P.C./
J. K. TIMMONS & ASSOCIATES, INC.

Ray E. Martin, Ph.D., P.E.
Commonwealth of Virginia

Submitted by:

Original signed by:
Carl S. Anderson, Jr.

Carl S. Anderson, Jr., P.E.
Acting Chief, Design Branch

Approved:

Original signed by:
Ronald E. Hudson

Ronald E. Hudson
Colonel, Corps of Engineers
Commander and District Engineer

Recommended by:

Original signed by
JACK G. STARR

Jack G. Starr, P.E.
Chief, Engineering Division

Date: SEP 23 1981

Leatherwood Dam No. 5 - Lake

Dam

Overview Photographs

SECTION 1 - PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of safety inspection of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (see Reference 1, Appendix VI). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Leatherwood Creek No. 5 Dam is a zoned earthfill structure approximately 510 ft long and 57 ft high.* The crest of the dam is 18 ft wide, and side slopes are approximately 2.5 horizontal to 1 vertical (2.5H:1V) on the upstream and downstream slopes of the dam. A 10 ft wide berm occurs between elevations 780.5 and 781.5 msl on the upstream slope, and between elevations 779.9 and 780.9 msl on the downstream slope. The upstream is 3H:1V below the berm. The crest of the dam is at elevation 809.2 msl. "As built" drawings show the presence of a core trench which extends to "firm bedrock" and a seepage drain beneath the downstream slope. There is no slope protection on the upstream face of the dam.

---

*Height is measured from the top of the dam to the downstream toe at the centerline of the stream.

The principal spillway consists of a reinforced concrete riser inlet. The riser has an internal opening of 9 ft by 3 ft, and is approximately 36 ft high. The riser has a low level orifice (3.0 ft by 1.5 ft) at an invert elevation of 780.3 msl and two overflow weirs at elevation 788.8 msl. A 36 inch by 24 inch slide gate in the riser at an invert elevation of 755.3 msl is used to drain the lake. The outlet pipe is a 36 inch diameter concrete pipe which outlets at an elevation 753 msl into a riprap lined plunge pool. (See Plates 5 and 7, Appendix I.)

The emergency spillway (EMS) consists of a vegetated earthen channel spillway located 375 ft right of the right abutment, having a crest elevation of 804.2 msl. The EMS has a bottom width of 200 ft at the control section and 3H:1V side slopes, and is entirely in a cut section. (See Plate 2, Appendix I.)

1.2.2 Location: Leatherwood Creek No. 5 Dam is located on Leatherwood Creek, 1.5 miles east of Leatherwood, Virginia. (See Plate 1, Appendix I.)

1.2.3 Size and Classification: The dam is classified as an intermediate size structure based on its height and maximum lake storage potential as defined in Reference 1, Appendix VI.

1.2.4 Hazard Classification: The dam is located in a rural area; however, based upon the proximity of an inhabited dwelling located 2 miles downstream, and several dwellings 5 miles downstream, the dam is assigned a "significant" hazard classification. The hazard

classification used to categorize a dam is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: The dam is owned and maintained by Mr. Billy B. Lawrence and Mr. Coleman B. Lawrence of Henry County, Virginia.

1.2.6 Purpose: Recreation, irrigation and flood control.

1.2.7 Design and Construction History: The dam was designed and constructed under the supervision of the United States Department of Agriculture (USDA), Soil Conservation Service (SCS). The structure was constructed by C. S. Horton and completed in November, 1963.

1.2.8 Normal Operational Procedures: The principal spillway is ungated, therefore, water rising above the low level orifice and overflow weirs of the riser outlet is automatically discharged downstream. Normal pool is maintained at elevation 780.5 msl just above the invert of the low level orifice in the riser. Flood discharges which cannot be absorbed by storage and the riser, flow through the emergency spillway at pool elevations above 804.2 msl. The 36 inch diameter gate at elevation 755.3 msl is manually operated, and is available to lower the lake elevation below normal pool for maintenance purposes.

1.3 Pertinent Data:

1.3.1 Drainage Area: The drainage area is 11.5 square miles.

1.3.2 Discharge at Dam Site:

Principal Spillway Discharge:

Pool Elevation at Crest of Dam (elev 809.2) 202 CFS

Emergency Spillway Discharge:

Pool Elevation at Crest of Dam (elev 809.2) 6103 CFS

1.3.3 Dam and Reservoir Data: See Table 1.1, below:

Table 1.1 - DAM AND RESERVOIR DATA

	Reservoir				
			Storage		
	Elevation feet msl	Area Acres	Volume Acre Feet	Watershed Inches	Length Miles
Crest of Dam	809.2	172	2997	4.9	2.2
Emergency Spillway Crest	804.2	130	2218	3.6	2.0
Low Level Orifice Crest	780.3	31	235	.4	1.0
Streambed at Downstream Toe of Dam	752.0	-	-	-	-

SECTION 2 - ENGINEERING DATA

2.1 Design: The dam was designed and constructed under the direction of the USDA, Soil Conservation Service (SCS). "As built" drawings and design data are available in the office of the State Conservationist, U. S. Soil Conservation Service, Federal Building, Room 9201, 5th and Marshall Streets, Richmond, Virginia 23240.

A subsurface investigation was conducted at the site by the SCS during the initial design stages. The investigation consisted of excavating 26 test pits, drilling 4 test borings and 17 hand augers. Subsurface profiles and a report of the investigation with foundation recommendations were prepared based upon geologic field reconnaissance, test pit and boring data, and laboratory testing. A copy of the design report is included as Appendix IV. Test pit and boring locations are provided on Plate 2 of Appendix I. Subsurface profiles and logs are shown on Plate 3 of Appendix I.

The dam is a zoned, compacted earthfill embankment. The earthfill requirements shown on Plate 4 of Appendix I specify that MH and ML materials be placed in Section 1, i.e., the core of the dam. Soil classification is by the Unified Soil Classification System, ASTM D-2487. The upstream slope and crest (Section No. 2) and the downstream slope (Section No. 3) were all to be constructed with SM materials, however, selected borrow areas for each section of the embankment were specified. "As built" embankment slopes for the structure are illustrated on Plate 4 of Appendix I.

A review of design data indicates the dam is founded on overburden and includes a cutoff trench which extends through alluvial and residual soils to "firm bedrock." The cutoff also extends to the same materials in both abutments. The cutoff trench has a bottom width of 14 ft and 1H:1V side slopes. No field permeability tests were taken during the subsurface investigation, however, permeability tests made on two undisturbed samples obtained from TH #302 indicated vertical permeabilities of k = 14.3 ft/day for the 3 to 5 ft sample (coarse, low density SM material) and k = 0.07 ft/day for the 9 to 11 ft sample (dense find sand). It was noted that the coarse material piped during performance of consolidation tests.

Although a positive cutoff was specified, a seepage drain was included beneath the downstream slope. The design report recommended that a trench drain at "c/b = 0.6" be constructed to control the phreatic line and relieve pressures from seepage through the partially weathered rock. "In depth it should extend down into weathered rock. It should extend up both abutments to the sediment pool elevation as a blind trench. A perforated pipe outlet should extend across the floodplain from Station 1 + 70 to 3 + 00." Details for the "as built" toe drain are included on Plate 4 of Appendix I.

The principal spillway was designed as a drop inlet structure consisting of a reinforced concrete riser, a 36 inch conduit and plunge pool at the outlet end of the conduit. The principal spillway was designed to accommodate a 100 year flood without the pool elevation exceeding the EMS crest.

The emergency spillway is located in a moderately sloping hillside in the right abutment. The spillway is a 200 ft wide trapezoidal earthen channel bounded by 3H:1V cut slopes. The spillway is entirely in cut materials, i.e., residual soils. All materials encountered in the subsurface investigation were dry and well drained. Details of the spillway section are given on Plate 2 of Appendix I.

The design report and supplementary data provided by SCS (Appendix V) includes laboratory test data describing the physical properties of the materials used to construct the embankment. Shear strength parameters used in design of the embankment, and foundation material were determined by direct shear and consolidated undrained triaxial compression tests as follows:

SECTION	SOIL	SHEAR STRENGTH PARAMETERS	
		Angle of Internal Friction	Cohesion
Embankment	SM	$\phi_{cu} = 28.0^{o}$	c = 450 psf
	MH	$\phi_{cu} = 14.5^{o}$	c = 1025 psf
	SM	$\phi_{cu} = 22.5^{o}$	c = 500 psf
Foundation	SM	$\phi_{cu} = 19^{o}$	c = 800 psf
	SM	$\phi_{DS} = 25.5^{o}$	c = 100 psf
	SM	$\phi_{cu} = 29^{o}$	c = 950 psf

Embankment stability was checked by the Swedish Circle Method Analysis and a factor of safety of 1.40 was calculated for full drawdown on the upstream slope (2.5H:1V with berm, then 3H:1V). A factor of safety of 1.47 was calculated for steady seepage on the downstream slope (2.5H:1V). The design report stated, "strength shown by shear tests on the foundation indicate failure would not occur through the foundation if low density surface material is removed."

2.2 Construction: The construction records were not furnished by the SCS office in Richmond, but they are available from the SCS office in Washington, D. C.

2.3 Evaluation: "As built" drawings are representative of the structure. Hydrologic and hydraulic calculations were available for evaluation. There is sufficient information to evaluate foundation conditions and embankment stability.

SECTION 3 - VISUAL INSPECTION

3.1 Findings: At the time of inspection, the dam appeared to be in good condition. Field observations are outlined in Appendix III.

3.1.1 General: An inspection was made on June 30, 1981 and the weather was cloudy with a temperature of 85°F. The pool and tailwater levels at the time of inspection were 780.5 and 752 msl, respectively, which corresponds to normal pool and tailwater elevations. Ground conditions were dry at the time of the inspection. Maintenance inspections are performed jointly by SCS and the Blue Ridge Soil and Water Conservation District on an annual basis. Inspection reports are available in the Soil and Water Conservation District office in Collinsville, Virginia.

3.1.2 Dam and Spillway: The embankment slopes were heavily vegetated with brush, briers or blackberry bushes and honeysuckle making observation difficult. Scattered small trees 3 to 4 ft$^{+}_{-}$ high and less than one inch in diameter were also present. Scattered cut cedars and pines generally less than two inches in diameter have been cut and left on the embankment slopes, particularly along the downstream slope. Some small trees were also growing from the riprap gutters along the downstream slope.

The embankment crest has some minor erosion due to vehicular traffic, but the crest is well grassed and this appears to be no problem. Along the left downstream abutment-slope contact above the berm, scattered erosional notches 1 to 2 ft$^{+}_{-}$ wide and 1 to 2 ft$^{+}_{-}$ deep were noted. Some sloughing was also noted near the berm. The erosion appears to be the result of surface runoff. Along the right downstream abutment-slope contact and below the berm, portions of the riprap gutter appeared to be displaced. See field sketch, Appendix III.

The downstream toe was dry and no seepage was observed. Some iron staining was noted around the plunge pool, but this may be related to spring flow through iron-bearing bedrock. Two 6-inch CMP toe drains exist, one on either side of the principal spillway outlet. There was no flow from the left drain. Flow from the right drain was clear and estimated at 2 gpm^{+}.

The riser structure and outlet pipe showed no signs of deterioration and were functioning properly at the time of inspection. Debris was not present in the low level intake trash rack. The plunge pool and outlet channel indicated no signs of deterioration. The emergency spillway was well vegetated except for some minor erosion due to several cattle paths and vehicle traffic.

3.1.3 Reservoir Area: The reservoir area was free of debris and the perimeter was wooded. The reservoir is located in a valley with steep side slopes. Water was clear and sedimentation was not observed.

3.1.4 Downstream Area: The downstream channel is 20 ft wide and is located in a 300 ft wide flood plain with steep valley side slopes. This valley is heavily wooded except for an area 300 ft right of the channel, which is a meadow. Approximately 2 miles downstream there is a dwelling about 15 ft above the stream channel. Five (5) miles downstream there are several dwellings about 10 ft above the stream channel and several commercial facilities 15 ft above the stream channel.

3.1.5 Instrumentation: No instrumentation (monuments, observation wells, piezometers, etc) was encountered for the structure. There is no staff gage.

3.2 Evaluation:

3.2.1 Dam and Spillway: Overall, the dam was in good condition at the time of the inspection. An annual inspection and maintenance program exists for this structure, however, at the time of this inspection, maintenance appeared to be inadequate. The embankment, including its crest and slopes should be mowed at least once a year, but more preferably twice a year. The presence of trees on the embankment, may promote the development of deep rooted vegetation and this type growth can encourage piping within an embankment. All trees growing on the embankment and in the riprap gutters should be cut to the ground. Cut trees should be removed from the embankment.

The rutting created by vehicular traffic on the crest of the dam does not inhibit the proper performance of the dam, however, it is recommended that these areas be backfilled and reseeded. The eroded areas present in the emergency spillway should be reseeded. The shallow eroded areas present along the left downstream abutment-slope contact should be stabilized to prevent further erosion. This might be accomplished with riprap or by backfilling and reseeding. The areas of displaced riprap along the right downstream abutment-slope contact should be monitored during maintenance operations to detect the development of erosion. If erosion should occur, we recommend that the missing riprap be replaced in these areas.

The outlet pipe and intake structure are in good structural condition. A staff gage should be installed to monitor water levels.

3.2.2 Downstream Area: A breach in the Leatherwood Creek No. 5 Dam during extreme flooding would possibly create a hazard to the downstream dwellings.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: The normal storage pool is elevation 780.5 msl or 0.2 ft above the crest of the principal spillway low flow inlet. The lake provides an irrigation supply, flood control and recreation. Water automatically passes through the principal spillway as the water level in the reservoir rises above the low level orifice. Water will also pass automatically through the riser overflow crest when the water level in the reservoir exceeds elevation 788.8 msl and automatically through the emergency spillway when the pool level exceeds elevation 804.2 msl. A 36 inch by 24 inch slide gate at the low point in the riser structure is provided to drawdown the reservoir below normal pool.

4.2 Maintenance of Dam and Appurtenances: Maintenance is the responsibility of the owner and the Blue Ridge Soil and Water Conservation District. Maintenance is accomplished by a joint annual inspection by SCS and Soil and Water Conservation District personnel. Maintenance deficiences are noted and recommended remedial measures are made to the owner. If the owner fails to comply with these recommendations, maintenance is then performed by the Blue Ridge Soil and Water Conservation District.

4.3 Warning System: At the present time, there is no warning system or evacuation plan for the dam. The dam is monitored by SCS personnel during periods of heavy precipitation and runoff.

4.4 Evaluation: The dam and appurtenances are in good operating condition, but maintenance of the dam appeared to be inadequate. An emergency operation and warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

a. How to operate the dam during an emergency.

b. Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5 - HYDRAULICS/HYDROLOGIC DATA

5.1 Design: Leatherwood Creek No. 5 Dam was designed by the Soil Conservation Service (SCS) as a multi-purpose dam, and hydrologic and hydraulic data are available. Stage-storage and stage-discharge data from the design report were used in the evaluation. This structure is a Class "A" dam according to the SCS classification method.

5.2 Hydrologic Records: There are no records available.

5.3 Flood Experience: Information on flood experience was not available.

5.4 Flood Potentials: In accordance with the established guidelines, the Spillway Design Flood (SDF) is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region), or fractions thereof. The Probable Maximum Flood (PMF) and ½ PMF hydrographs were developed by the HEC-1 DB Computer Program (Reference 4, Appendix VI). Precipitation amounts for the flood hydrograph of the PMF were taken from the U.S. Weather Bureau Information (References 5 and 6, Appendix VI). Appropriate adjustments for basin size and shape were accounted for. These hydrographs were routed through the reservoir to determine maximum pool elevations.

5.5 Reservoir Regulations: For routing purposes, the pool at the beginning of flood was assumed to be at elevation 780.3 msl. Reservoir stage-storage data and stage-discharge data were utilized from the existing design report. Floods were routed through the reservoir using the principal spillway discharge up to a pool storage elevation of 804.2 msl and a combined principal and emergency discharges for pool elevations above 804.2 msl. Pool elevations above 809.2 msl were routed over the non-overflow section of the dam.

5.6 Overtopping Potential: The predicted rise of the reservoir pool and other pertinent data were determined by routing the flood hydrographs through the reservoir as previously described. The results for the flood conditions (½ PMF and PMF) are shown in the following Table 5.1:

TABLE 5.1 - RESERVOIR PERFORMANCE

		Hydrograph	
	Normal Flow	½ PMF	PMF
Peak Flow, CFS			
Inflow	11	21,607	43,214
Outflow	11	13,195	30,998
Maximum Pool Elevation Ft, msl	780.5	811	814.1
Non-Overflow Section (Elev 809.2 msl)			
Depth of Flow, Ft	-	1.8	4.9
Duration, Hours	-	5.5	8
Velocity, fps*	-	5.9	9.7
Tailwater Elevation Ft, msl	752	761.3	764

*Critical velocity

5.7 Reservoir Emptying Potential: A 36 inch by 24 inch gate at an elevation 755.3 msl is capable of draining the reservoir through the outlet pipe. Assuming that the lake is at normal pool elevation (780.5 msl) there is 11 cfs inflow, it would take approximately 1.5 days to lower the reservoir to elevation 756.3 msl. This is equivalent to an approximate drawdown rate of 7.5 ft/day based on the hydraulic height measured from normal pool to the invert of the drawdown pipe divided by the time to dewater the reservoir.

5.8 Evaluation: The U. S. Army, Corps of Engineers' guidelines indicate the appropriate Spillway Design Flood (SDF) for an intermediate size, significant hazard dam is the ½ PMF to PMF. Because of the risk involved, the ½ PMF has been selected as the SDF. The spillway will pass 30 percent of the PMF without overtopping the crest of the dam (60 percent of the SDF). During the SDF, the dam will be overtopped for a period of 5.5 hours up to a maximum of 1.8 feet and reach a maximum velocity of 5.9 fps.

Hydrologic data used in the evaluation pertains to present day conditions with no consideration given to future development.

SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: The dam is located along the western edge of the Piedmont Physiographic Province of Virginia. The original design report described the site as being underlain by the Leatherwood Granite; however, recent detailed geologic mapping indicates the site is actually underlain by the Rich Acres Formation of Precambrian Age (1020 million years old). The Rich Acres Formation consists of coarse grained norites, metamorphosed gabbros and diorites. These rocks are similar in texture to granites, but are comprised of more basic or darker colored minerals. Detailed geologic maps of the area do not indicate the presence of any faults in the site vicinity. Site geology is presented in more detail in the Design Geologic Report, which is included as Appendix IV.

The subsurface investigation indicated that along centerline of the dam the site was underlain by shallow alluvial and residual soils over weathered bedrock. The bedrock surface was somewhat irregular along the principal spillway. Bedrock was encountered at ground surface near the center of the section, at depths of 10 to 12 ft near the riser and below 13 ft at the outlet. "Hard to firm" bedrock was encountered in the abutments. Although some of the rock was deeply weathered, all exploration holes were dry and the materials encountered were well drained.

A consolidation test was performed on a soil sample considered representative of the foundation materials. The sample classified SM to

SP and a potential consolidation of 0.032 ft/ft was determined under the proposed embankment load. Since most of the materials were finer grained than the tested sample, a potential settlement of 4% was assumed in design for the surface 10 ft. For the embankment an over fill of 2.25 ft was recommended in the design report from Station 1 + 70 to 3 + 00 to compensate for residual settlement. It was recommended in the design report that "in addition to normal stripping, all low density surface materials should be excavated and replaced as compact fill. Material below 77.0 pcf on a dry weight basis should be removed in this operation." Otherwise, no other special foundation treatment was required.

The potential for seepage through the foundation was recognized and a cutoff extending to firm bedrock was specified. Moderate permeabilities were anticipated for the overburden soils and the designer expected some seepage through all weathered bedrock.

6.2 Embankment:

6.2.1 Materials: "As built" drawings describe the dam as a zoned structure. Section 1 of the dam, consisting of the cutoff and interior core, was constructed with soils classifying as ML and MH. Section 2 (the upstream slope and crest) and Section 3 (the downsteam slope) were constructed with SM materials excavated from select borrow areas. The coarsest SM materials were to be placed on the downstream slope. Materials in all three sections were to be compacted to 95% of maximum dry density in accordance with ASTM Standard D-698 (Standard Proctor). Compacted densities and shear strength values for the embankment materials are summarized on Page 2 of Appendix V. Specifications for maximum lift thickness and maximum rock sizes were not observed in the design data provided.

6.2.2 Subdrains and Seepage: In attempt to control seepage, a cutoff was constructed to firm bedrock below the more permeable alluvial soils in the flood plain and extending into the abutments. Details are shown on Plate 4 of Appendix I. An internal drainage system was also constructed, consisting of 120 ft of 6 inch perforated bituminous coated CMP enclosed in an envelope of graded drain fill of variable depth. Drainage pipes were provided for transmitting the collected water to the plunge pool. During the field inspection, clear flow estimated at 2 gpm± was observed from the right outlet, however, no flow was observed from the left outlet. In attempt to prevent piping around the principal spillway pipe, 9 anti-seep collars were included as shown on Plate 5 of Appendix I.

6.2.3 Stability: A stability analysis was performed for this structure and the report describing the engineering design data used is included in Appendix V. These data were reviewed along with the stability analysis and were found to be acceptable. The factor of safety of the upstream slope for the drawdown condition is 1.40 as given in Appendix V. Reference 1, Appendix VI, recommends a factor of safety of 1.2. The factor of safety for the downstream slope under steady seepage conditions is indicated to be 1.47. The required factor of safety is 1.5 according to Reference 1.

The dam is 57.2 ft high and has a crest width of 18 ft. The upstream slope is 2.5H:1V with a 10 ft wide berm at pool level between elevations 780.5 and 781.5 msl. The upstream slope then continues at a 3H:1V slope below normal pool. The downstream slope is 2.5H:1V with a 10 ft wide berm occurring between elevations 779.9 and 780.9 msl. The dam is subjected to a sudden drawdown since the lake level can be drawn down at a rate of 7.5 ft/day. This exceeds the critical rate of 0.5 ft per day for earth dams.

6.2.4 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: Based upon the visual inspection and the design report, the foundation is considered sound. The factor of safety for the upstream slope during the drawdown condition meets the U. S. Army, Corps of Engineers guidelines. Although the factor of safety of 1.47 calculated for the downstream slope under steady seepage condition is slightly less than the 1.5 factor of safety recommended in Reference 1, Appendix VI, this difference is considered insignificant, particularly in lieu of the performance history of this structure.

Overtopping is not considered detrimental to the dam with respect to erosion because of the shallow depth and short duration of flood. Also the critical velocity is slightly less than 6 fps, the assumed effective eroding velocity for a vegetated earth embankment.

Since no undue settlement, cracking or sloughing was noted at the time of inspection, it appears that the embankment is adequate for maximum control storage with water at elevation 780.5 msl.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: Sufficient engineering data is available for assessing the dam. The visual inspection revealed no findings that proved the dam to be unsound. There is an annual inspection and maintenance program for this structure, but there is no emergency operation and warning plan. Overall, the dam was in good condition at the time of inspection. U. S. Army, Corps of Engineers guidelines indicate the appropriate Spillway Design Flood (SDF) for this dam is the ½ PMF. The spillway will pass 30 percent of the PMF (60 percent of the SDF) without overtopping the crest of the dam. During the SDF the dam will be overtopped for a period of 5.5 hours up to a maximum of 1.8 feet and reach a maximum velocity of 5.9 fps. Flows overtopping the dam at a maximum velocity of 5.9 fps during the SDF are not considered detrimental to the embankment with respect to erosion. The spillway is judged inadequate, but not seriously inadequate. Review of available stability data indicates the structure is stable as designed.

7.2 Recommended Remedial Measures:

7.2.1 Emergency Operation and Warning Plan: It is recommended that a formal emergency procedure be prepared, prominently displayed, and furnished to all operating personnel. This should include:

1) How to operate the dam during an emergency.

2) Who to notify, including public officials, in case evacuation from the downstream area is necessary.

7.3 Required Maintenance: The inspection revealed the following maintenance items that should be scheduled by the owner during a regular maintenance period within the next 12 months.

a) The grass and weeds on the dam embankment and in the emergency spillway should be cut at least once a year and preferably twice a year. Maintenance is recommended in the early summer and fall.

b) Existing trees on the dam should be cut to the ground and removed from the embankment. All previously cut trees should be removed also.

c) The eroded area along the left downstream abutment-slope contact should be stabilized and reseeded.

d) Rutted areas observed on the embankment crest should be backfilled and reseeded.

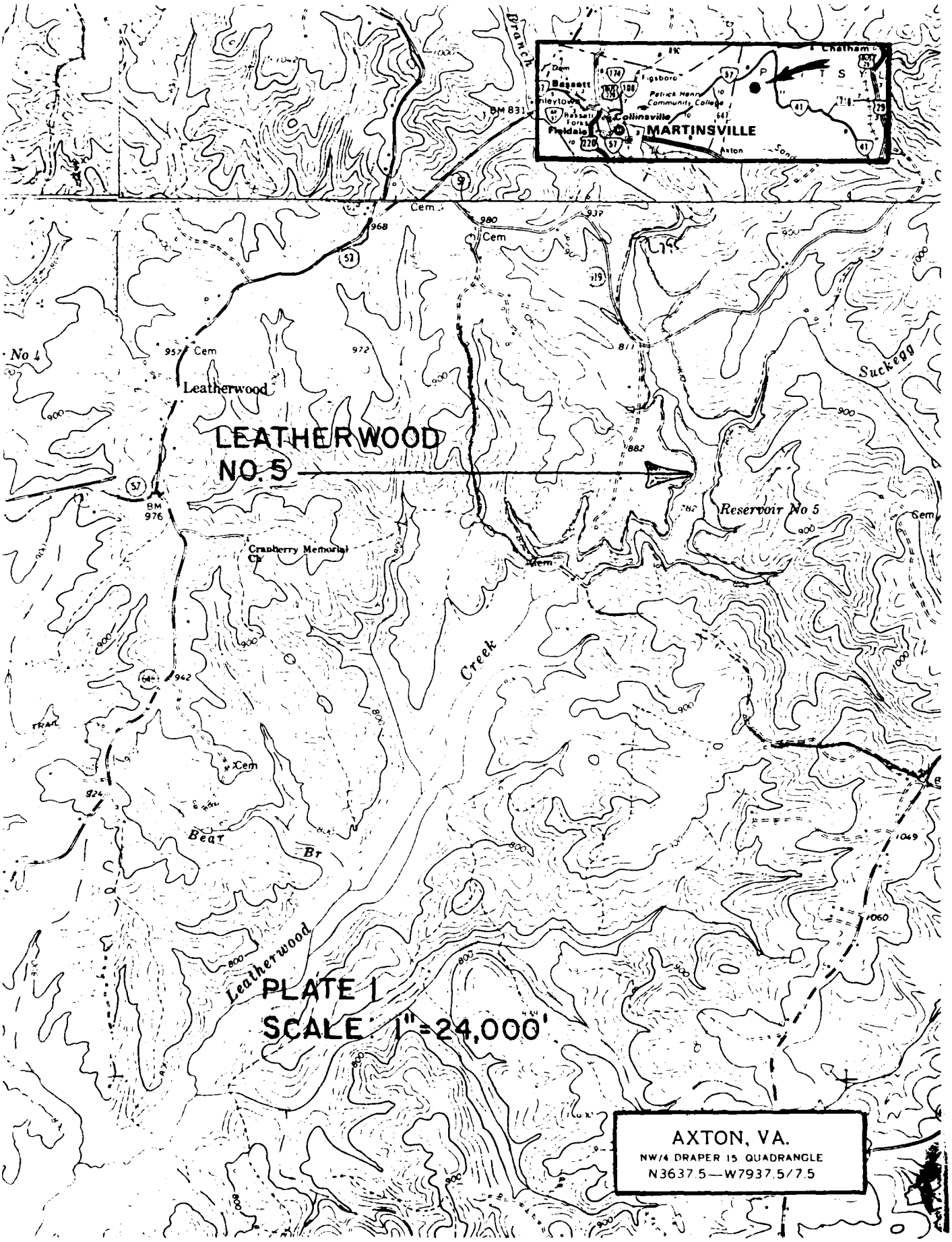
e) The eroded areas observed in the emergency spillway should be reseeded.

f) Areas of displaced riprap along the right downstream abutment-slope contact should be monitored during maintenance to detect the development of erosion. If erosion should occur, it is recommended that the missing riprap be replaced.

g) A staff gage should be installed to monitor water levels.

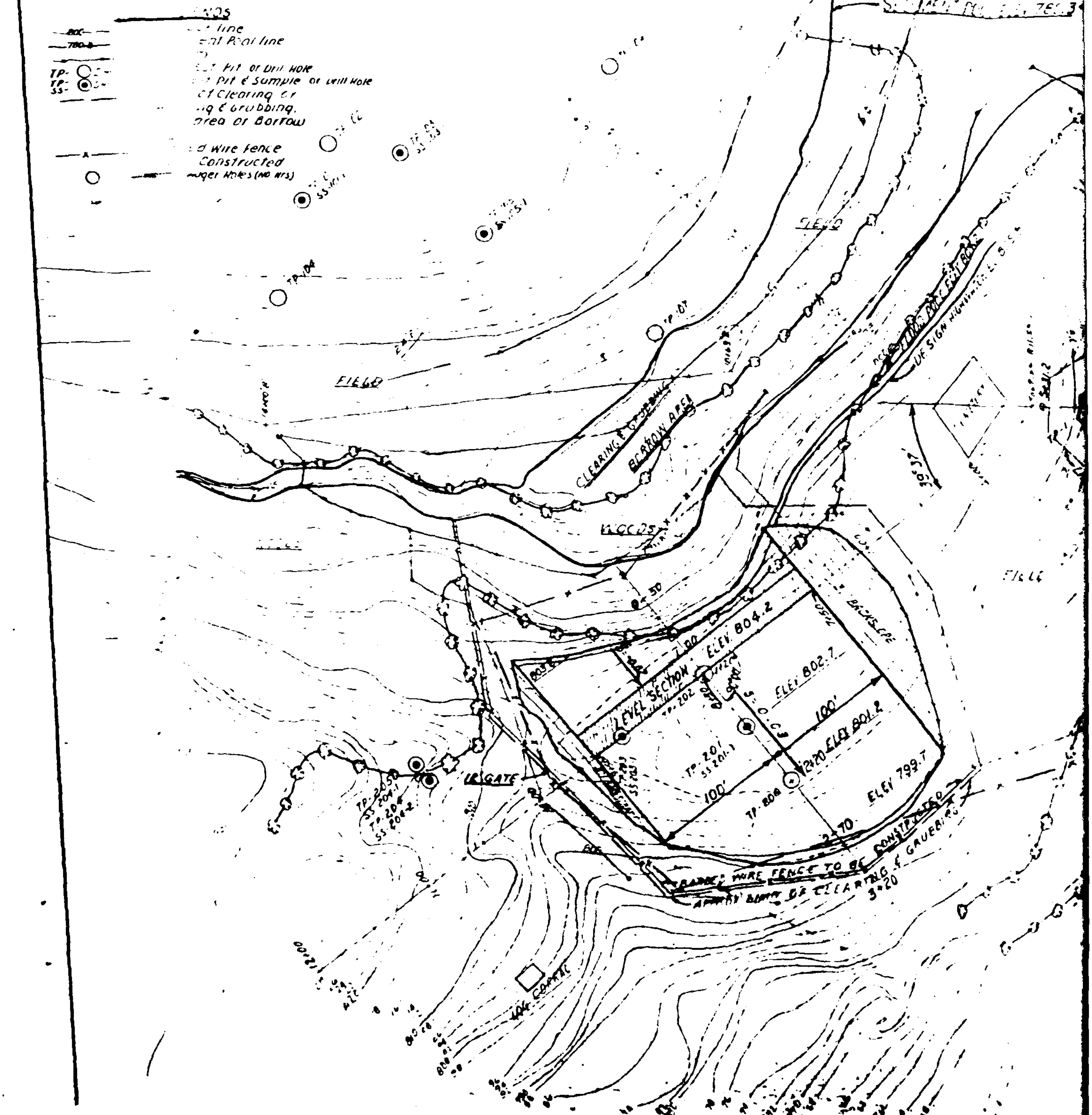
APPENDIX I

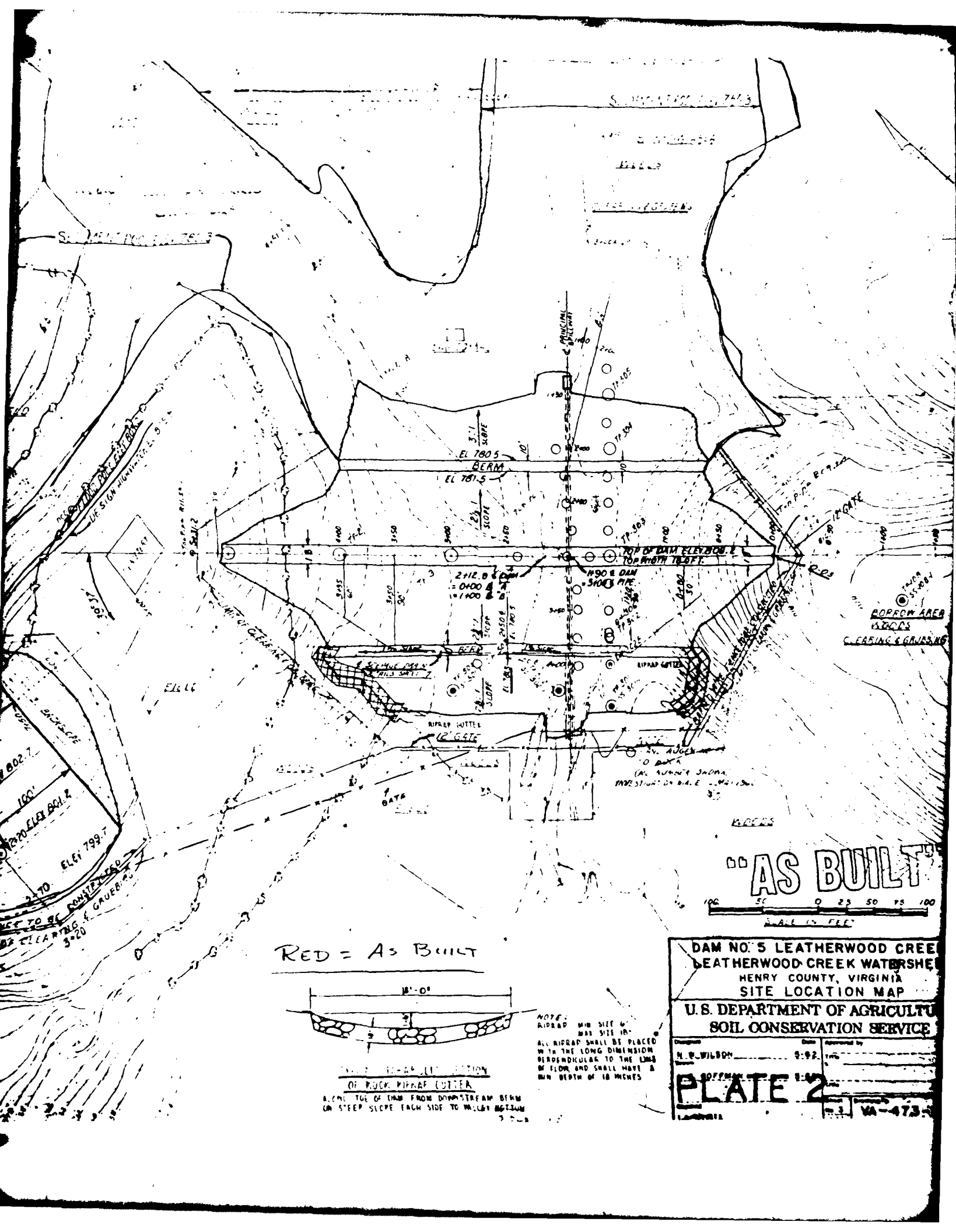
MAPS AND DRAWINGS


LEATHERWOOD
NO. 5
PLATE 1
SCALE 1"=24,000'
AXTON, VA.
NW/4 DRAPER 15 QUADRANGLE
N3637.5—W7937.5/7.5
MARTINSVILLE
Chatham
Collinsville
Fieldale
Bassett
Figsboro
Patrick Henry Community College
Axton
Leatherwood
Reservoir No 5
Cranberry Memorial Ch
Cem
BM 976
BM 831
Creek
Bear Br
Leatherwood
Suckegg
No 4

GENERAL NOTES

1. ... and Emergency ...
2. ... cleared & grubbed ... by the Engineer
3. ... Engineer
4. ... shall be class B2
5. ... Emergency Spillway bottom to be established by Engineer.
6. ... Acres of ... being Seeded and Mulching. This includes the embankment where ... Emergency Spillway Bottom and side slopes and other Disturbed areas.
7. ... of Fence & Gates to be determined by the Engineer ... is a part of the contract ... 12' GATES & APRON ... FENCE.




EL 780.5
BERM
EL 781.5
3:1 SLOPE
2½:1 SLOPE
TOP OF DAM ELEV 808.2
TOP WIDTH 10.0 FT.
12' GATE
RIPRAP OUTLET
BORROW AREA
ACCESS
CLEARING & GRUBBING
"AS BUILT"
RED = AS BUILT
OF ROCK RIPRAP CUTTER
NOTE:
ALL RIPRAP SHALL BE PLACED WITH THE LONG DIMENSION PERPENDICULAR TO THE LINE OF FLOW AND SHALL HAVE A MIN DEPTH OF 18 INCHES
DAM NO. 5 LEATHERWOOD CREEK
LEATHERWOOD CREEK WATERSHED
HENRY COUNTY, VIRGINIA
SITE LOCATION MAP
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
N. P. WILSON 9-92
PLATE 2
VA-473

TP-1 Elev. 8[illegible].5

[illegible] to SM, brown to dark brown, some mica very firm in place, can't penetrate with pocket penetrometer.
Highly weathered, very coarse granite, abundant feldspar and quartz, with mica, looks like a gneissic granite, firm to hard in place.
Weathered granite, firm and hard, hole dry.

Elev. 767.5

[illegible] silty sand fine some mica, SM

[illegible]ly weathered gneiss-schist very firm in place, hole dry. Reading on pocket penetrometer was greater than 3 tons sq.ft, to no penetration.

TP-3 Elev. 75[illegible].[illegible]

fine sand to silty sand, alluvial water at 4', hole caved. SM

weathered gneiss-schist, bedrock

TP-101 DS-101-1

SM [illegible] weathered gneiss, light tan to red-brown, fine material forms a SM, hole is dry and well drained.

TP-102

SM

TP-104 Elev. 797.0

SM or ML Silty sand, red brown may be a ML
SM Highly weathered gneiss schist with some intrusions of pegmatite.

Elev. 802.0

silty sand to sandy silt, some mica
ML to ML
SM or SM SM highly weathered gneiss-pegmatite forms a SM or SM silty sand and well drained.

TP-106 Elev. 802.0

SM to ML very fine silty sand to sandy silt red-brown, some mica
SM highly weathered gneiss-schist, some coarse feldspar and quartz grains, hole dry and well drained

TP-107 Elev. 783.0

SM to ML very fine to micaceous silty sand to sandy silt.
Highly weathered gneiss-schist, water at 3', this must be seepage from hill-water is 7' above stream level.

TP-[illegible] Elev.

SM
gneiss
fairly
consi
a SM

TP-202 Elev. 815.4

SM to ML Very highly weathered, red brown weathered gneiss-schist forms a very fine SM to ML, abundant mica.
SM to ML weathered gneiss-schist, micaceous SM to ML, very firm in place but excavates easy, dry and well drained.

Elev. 810.8

ML Red-brown sandy micaceous silt with some clay, residual gneiss-schist.
SM Highly weathered gneiss-schist-micaceous SM, hole dry and well drained.

TP-204 Elev. 814.5
DS-204-2

SM Highly weathered gneiss-schist, Some pegmatite present forms an SM, Sample 204-1 and 204-2 were taken from these two holes.

TP-205 Elev. 818.3
DS-204-1

SM to ML Highly weathered gneiss-schist, forms a very fine SM to ML.
These two samples represent a stratigraphic section of 16+ feet.

TP-301 Elev.
DS-301-1

SM
very
some
drain
SM
gray
and
poor
No

TP-303 Elev. 759.0

Bedrock at surface med. to coarse grained granite will need to excavate rock at this point.

TP-[illegible] Elev. 761.0

[illegible] ML
micaceous silty sand to sandy silt, Seepage zone at 5', thin layer of medium to fine sand, water at 5'.
SM or ML micaceous sandy silt or silty sand like above but finer.

weathered gneiss-schist, Hard bedrock.

TP-303 Elev. 761

SM to ML Mixed alluvium, fine SM to ML, very micaceous, light brown to tan, seepage zone at 6', thin layer of medium sand, some water at 6'.
Weathered gneiss-schist soft, Hard bedrock.

TP-501 Elev. 759.5
DS-501-1

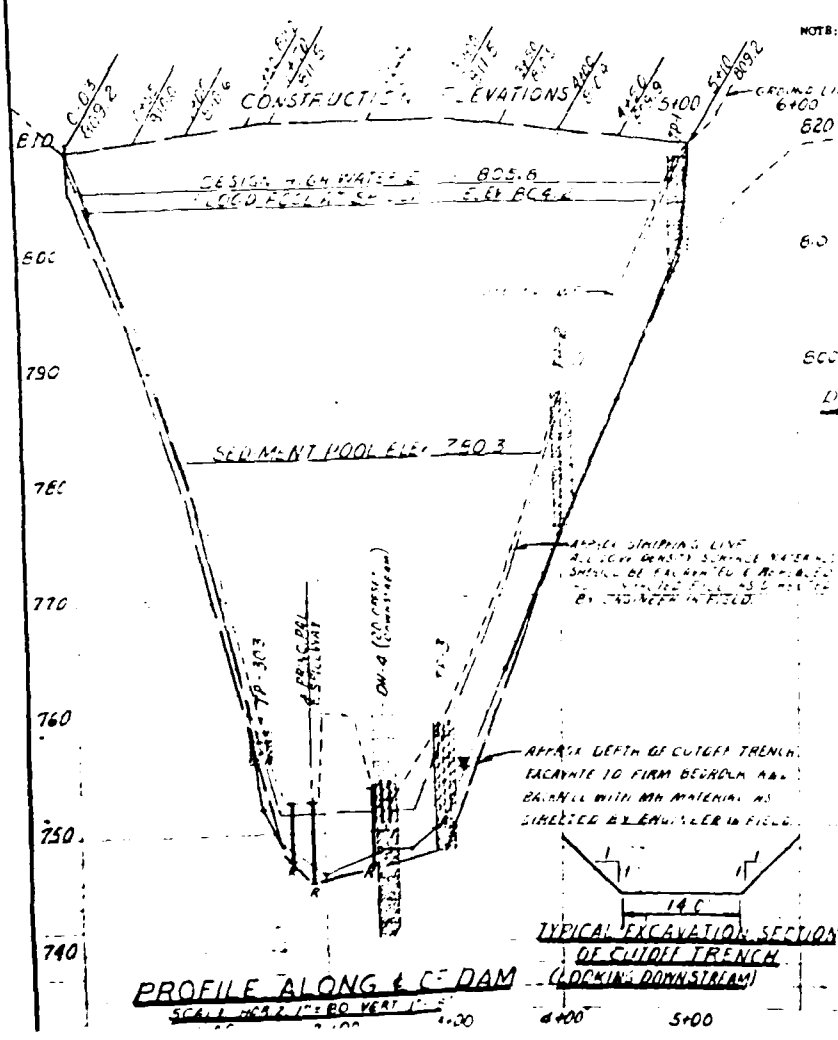
SM micaceous silty sand, appears to be enough sand to give it strength, water at 6', some angular fine quartz pebbles at 6'.
This is alluvial material - appears no change from 0-6' but may be finer 4 - 6'.

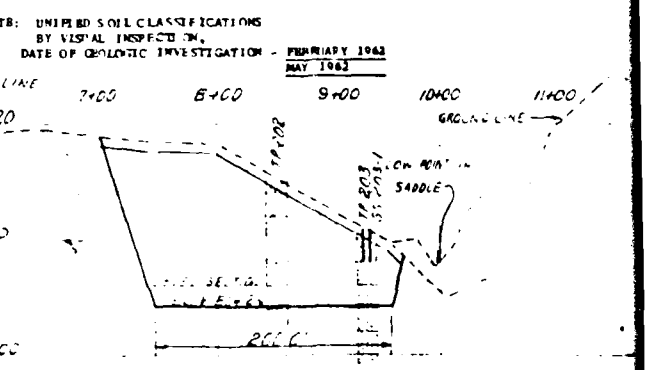
TP-502 Elev.

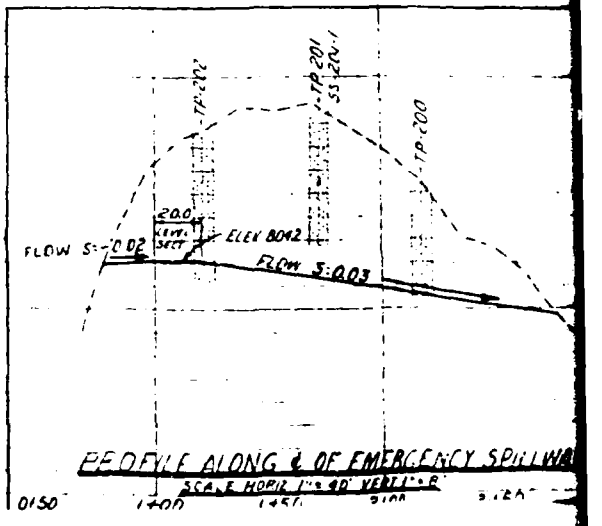
Very
micac

Fine
abund
in m

NOTE: UNIFIED SOIL CLASSIFICATIONS BY VISUAL INSPECTION,
DATE OF GEOLOGIC INVESTIGATION - FEBRUARY 1962
MAY 1962







TP-101
DS-101-1
SM Highly weathered gneiss-schist, light tan to red-brown. This material forms a SM, hole is dry and well drained.

TP-102
SM Silty sand, red brown [illegible] fine almost a sandy silt.
SM Highly weathered gneiss-schist with intrusions of pegmatite, forms an SM, some mica, hole dry.

SM or ML Silty sand very fine almost a ML, red-brown.
SM Highly weathered gneiss-schist forms an SM, some to abundant mica, hole dry.

[illegible]-4 Elev. 760.5
SM 0-6 Silty sand very fine, abundant mica
SM Some coarse sand in this [illegible] same
ML or CL 6-10 Sandy silt to clay
Gneiss, black and white, very hard
Gneiss, soft drilling
Gneiss, hard drilling, poor core

DH-302b Elev. 760
SM Very fine silty sand with abundant mica, 0-3
Very fine silty sand to sandy [illegible] silt, with abundant mica, to 5'
Thin lens of medium sand, 5-5.5 [illegible]
ML-CL 5.5-10 Soft
SM or SC 10-11.5 Silty to clayey sand, Mica
SM to GP 11.5-16 Coarse sand to fine
Gravel, SM to GP
Highly weathered gneiss to 18.5
Weathered gneiss to 20.8
Hard firm gneiss but some weathering, tried to core but no recovery, soft to medium drilling
Cored this section, hard drilling got poor recovery about 10%

TP-107 Elev. 783.0
SM to ML Very fine to micaceous silty sand to sandy silt.
Highly weathered gneiss-schist, water at 3', this must be seepage from hill-water is 7' above stream level.

TP-2[illegible] Elev. 811.0
SM to ML Highly weathered granite gneiss to quartz mica schist forms a SM to ML, some masses of coarse quartz and feldspar, almost a pegmatite, hole dry.

TP-201 Elev. 816.5
DS-201-1
SM Highly weathered granite gneiss-schist forms a micaceous silty sand.
SM Highly weathered but less weathered than above, hole dry

TP-205 Elev. 819.5
DS-204-1
SM to ML Highly weathered gneiss-schist, forms a very fine SM to ML.
These two samples represent a strategraphic section of 16+ feet.

TP-301 Elev. 761.0
DS-301-1
SM to SP Mixed alluvium. Fine to very fine sand, light brown to tan, some to abundant mica. Well-drained. Water at 8 feet.
SM to ML Silty sand, micaceous, gray to brown, some thin layers of med sand, but continuous but in pockets.
No bedrock at 13+ feet.

TP-302 Elev. 762.0
SM to SP Mixed alluvium, fine to very fine sand light brown to tan, some to abundant mica. Water at 8 feet.
SM to ML Silty sand micaceous like TP-301. No bedrock at 13'.

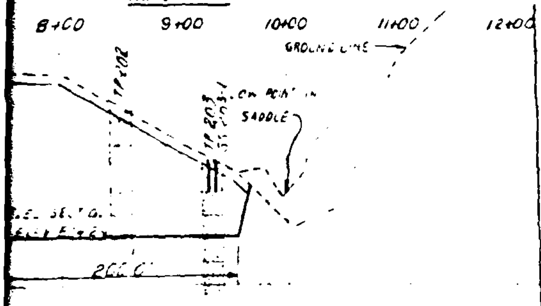
DH-306 Elev. 759.4
SM Silty sand very fine, micaceous
SM to ML Silty sand to sandy [illegible] or clay
Silty to poorly sorted sand, gray getting into highly weathered gneiss
Weathered gneiss

DH-505
SM Silty sand, very fine abundant mica, 0-3'
This material is almost an ML
ML or CL Sand silty to clay very micaceous from 3-4.5
Silty clay to clayey silt, abundant mica 4.5-8'
Highly weathered gneiss to 9.5
Weathered gneiss to 13.5
Weathered granite gneiss to weathered granite
Pink and white granite, with some black gneiss mixed in, large [illegible] and feldspar grains almost a pegmatite, lost water at 16.2'
Schist gneiss, abundant mica

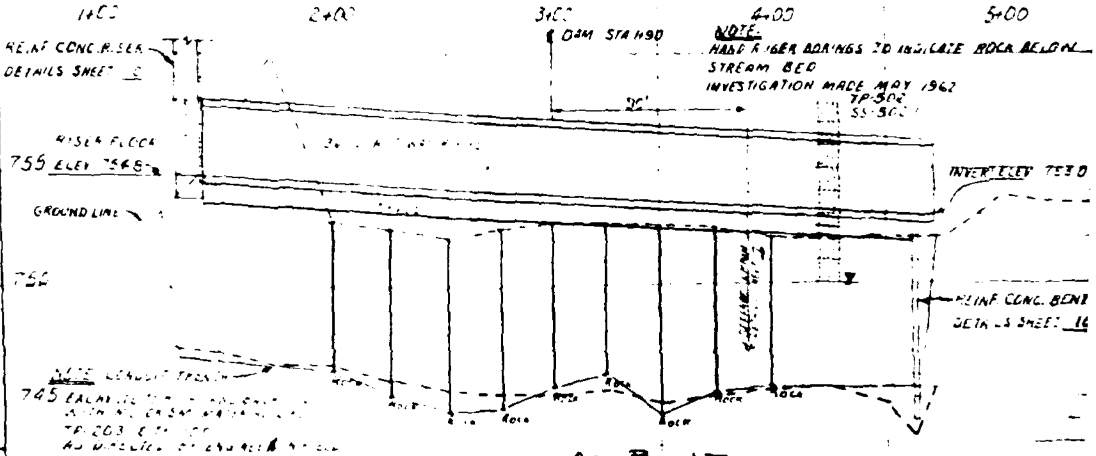
TP-501 Elev. 759.5
DS-501-1
SM Micaceous silty sand, appears to be enough sand to give it strength, water at 6', some angular fine quartz pebbles at 6'.
This is alluvial material - appears no change from 0-6' but may be finer 4 - 6'.

TP-502 Elev. 758.0
DS-502-1
Very fine poorly sorted sand, some mica. SM to SP
Fine to very fine SP - this is about stream level, water coming in at 8' - alluvial sand.

[illegible]FICATIONS
[illegible]ON.
[illegible]STIGATION - FEBRUARY 1962
MAY 1962

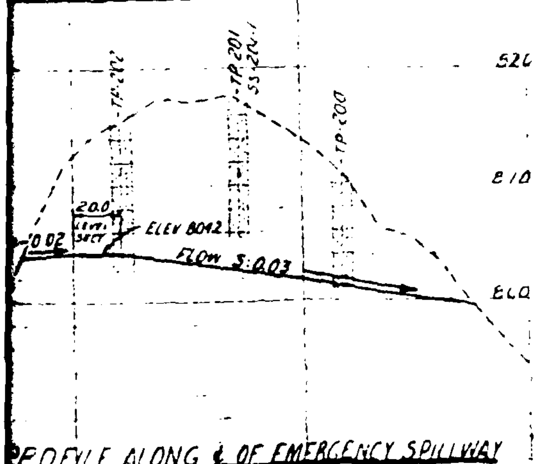


G LEVEL SECTION EMERGENCY SPILLWAY



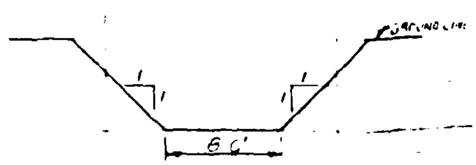
RED = AS BUILT

PROFILE ALONG ¢ OF PRINCIPAL SPILLWAY
SCALE HORIZ 1"=40' VERT 1"=4'



PROFILE ALONG ¢ OF EMERGENCY SPILLWAY
SCALE HORIZ 1"=40' VERT 1"=8'

"AS BUILT"

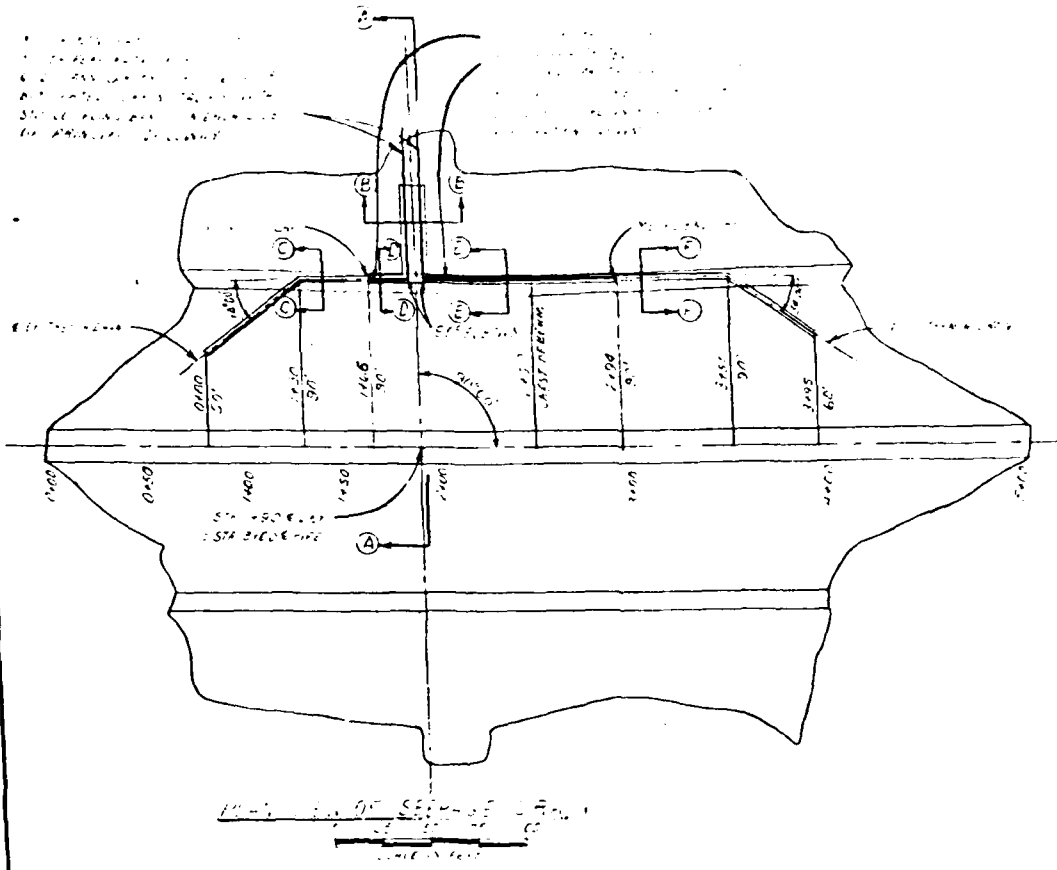


TYPICAL EXCAVATION OF CONDUIT TRENCH

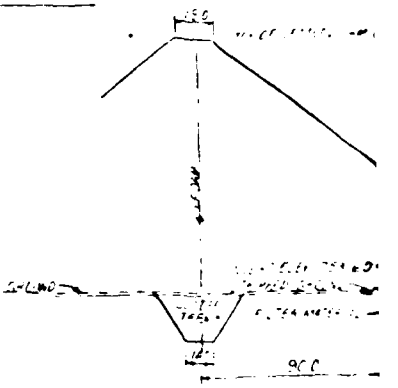
DAM NO. 5 LEATHERWOOD CREEK
LEATHERWOOD CREEK WATERSHED
HENRY COUNTY, VIRGINIA
SOILS INFORMATION AND PROFILE
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

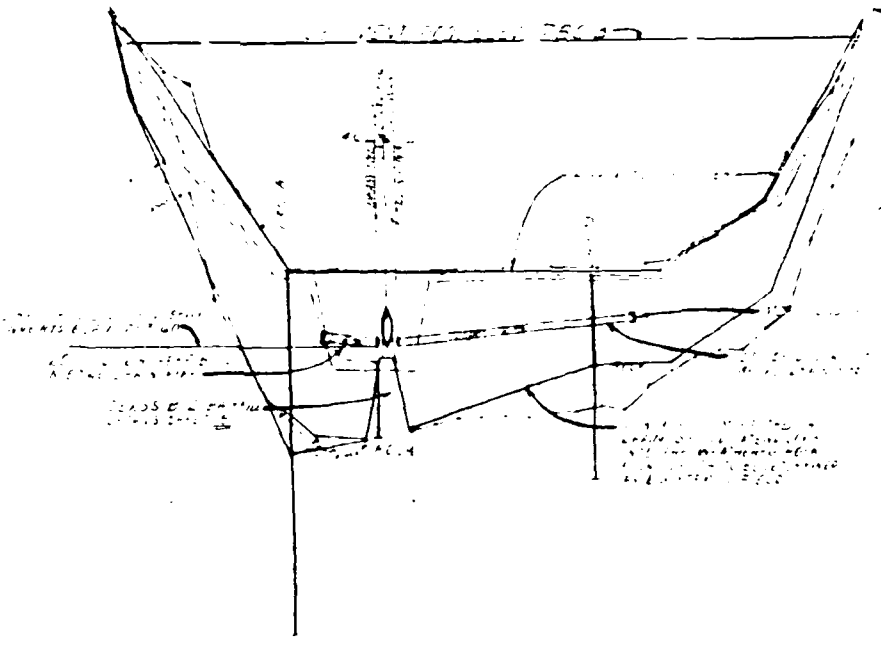
Designed	Date	Approved by
N. W. WILSON	5-62	
COFFMAN	6-62	
Checked		Sheet / Drawing No.

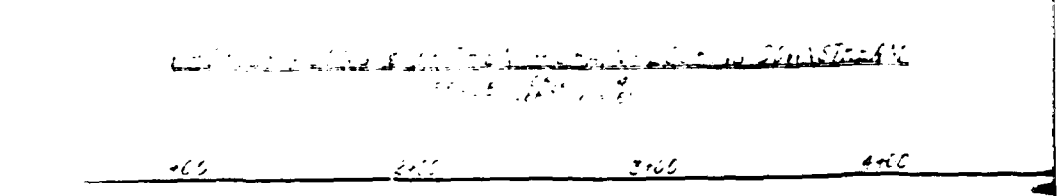
PLATE 3

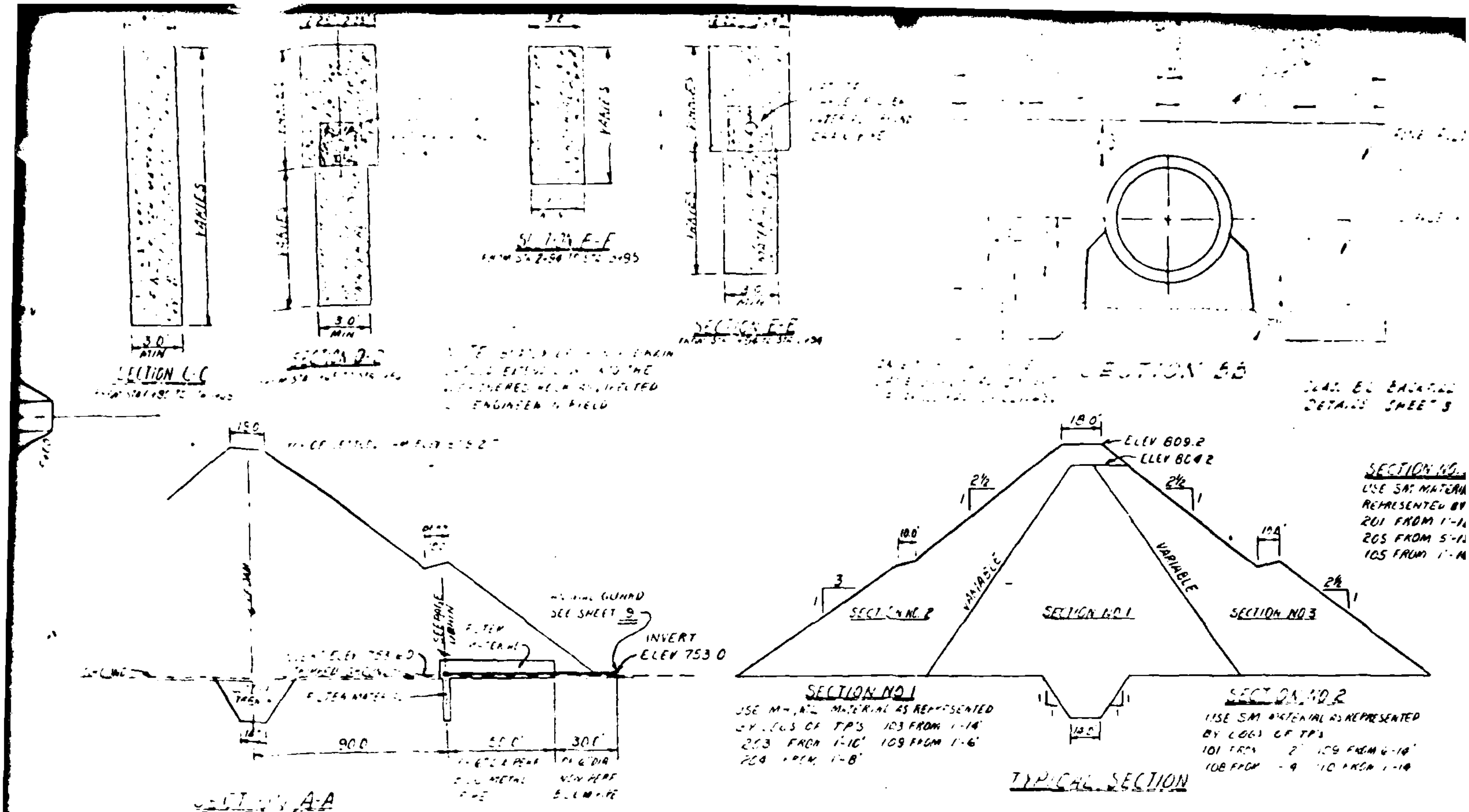



SECTION C-C







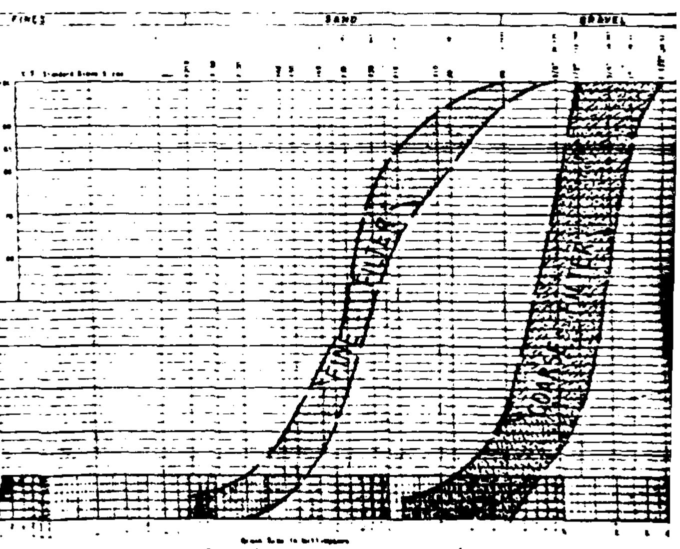


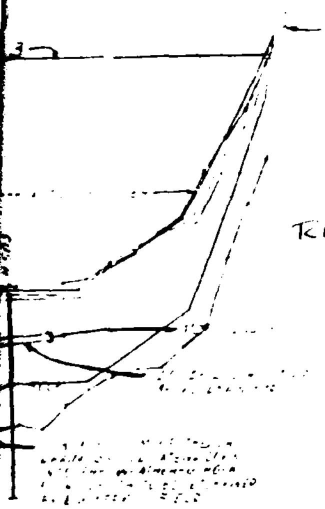
GRAIN SIZE DISTRIBUTION GRAPH

FINE FILTER	
3/8"	100
# 4	95 - 100
# 8	80 - 95
# 16	65 - 85
# 30	30 - 50
# 50	8 - 25
# 100	0 - 10
# 200	0 - 5

(NATURAL SAND A)

COARSE FILTER	
1½"	100
1"	85 - 100
3/4"	60 - 100
1/2"	25 - 100
3/8"	18 - 75
# 4	0 - 25
# 8	0 - 10
# 16	0 - 5





RED = AS BUILT

3+00 4+00 5+00

"AS BUILT"

DAM NO. 5 LEATHERWOOD CR
LEATHERWOOD CREEK WATER
HENRY COUNTY, VIRGINIA
DETAILS OF SEEPAGE DRAI

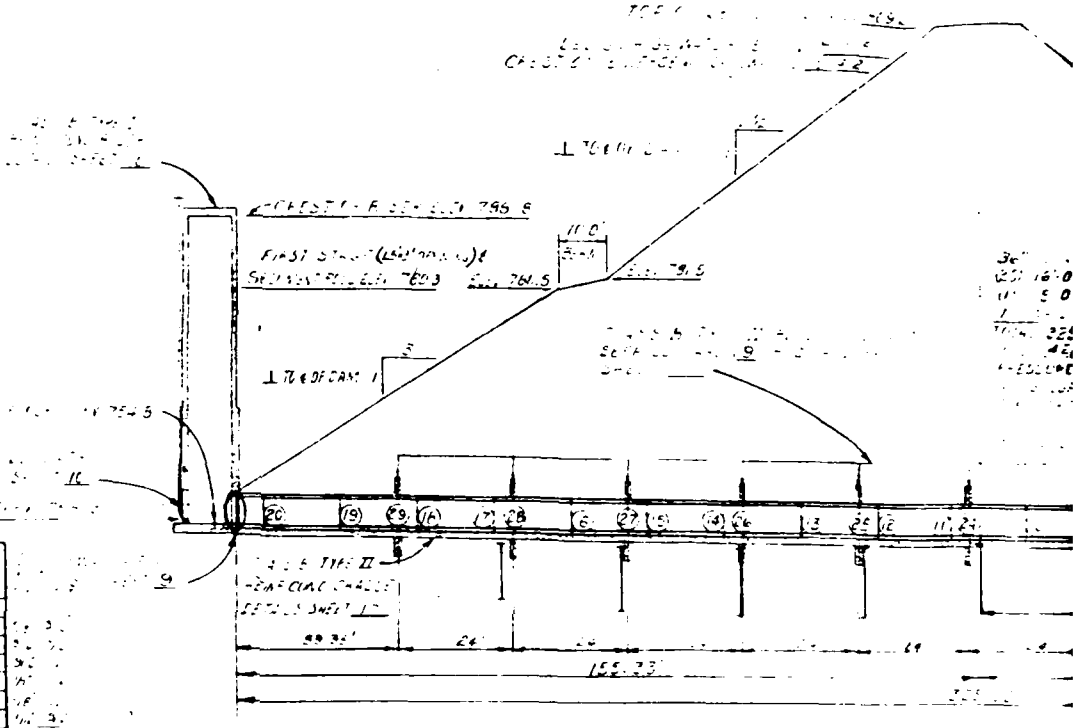
U S DEPARTMENT OF AGRICUL
SOIL CONSERVATION SERVI

N. W. WILSON 6-62

PLATE 4

VA-47

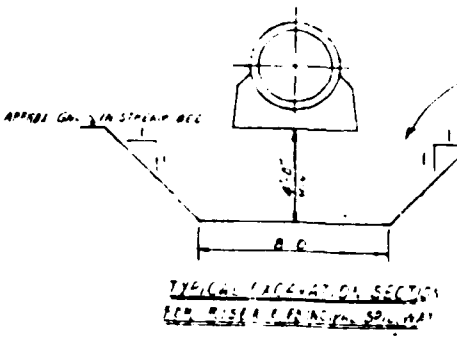
As Built

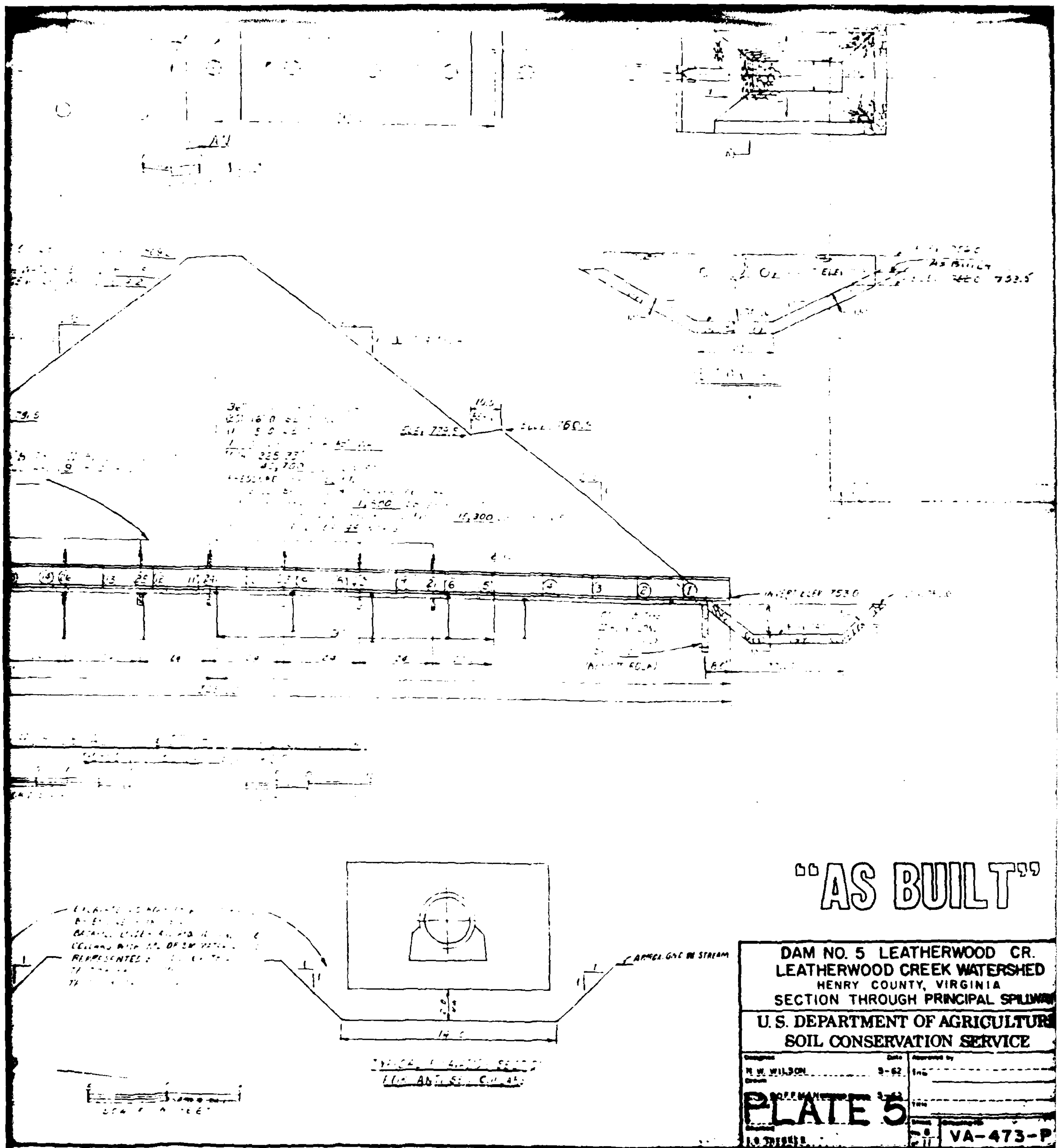


POINT	DISTANCE FROM DOWNSTREAM END OF 36" D PIPE (FEET)	INVERT ELEV OF 36" D PIPE WITH CAMBER
OUTLET	0	755.00
1	16.00	755.12
2	32.00	755.24
3	48.00	755.36
4	64.00	755.48
5	80.00	755.60
6	96.00	755.72
7	112.00	755.83
8	128.00	755.94
9	144.00	756.05
10	160.00	756.16
11	176.00	756.27
12	192.00	756.33
13	208.00	756.39
14	224.00	756.45
15	240.00	756.51
16	256.00	756.57
17	272.00	756.63
18	288.00	756.68
19	304.00	756.73
20	320.00	756.78
BALL PIECE	325.00	756.80
RISER	325.33	756.80
ANTI-SEEP COLLARS		
OUTLET	0	755.00
SEEPAGE DRAIN	80.00	755.60
21	100.00	755.74
22	124.00	755.91
23	148.00	756.08
24	172.00	756.24
25	196.00	756.35
26	220.00	756.44
27	244.00	756.53
28	268.00	756.62
29	292.00	756.70
BALL PIECE	325.00	756.80
RISER	325.33	756.80

NOTE: ABOVE DIMENSIONS OF PIPE LENGTHS ARE BASED ON NOMINAL SIZE AND DO NOT INCLUDE CREEP.

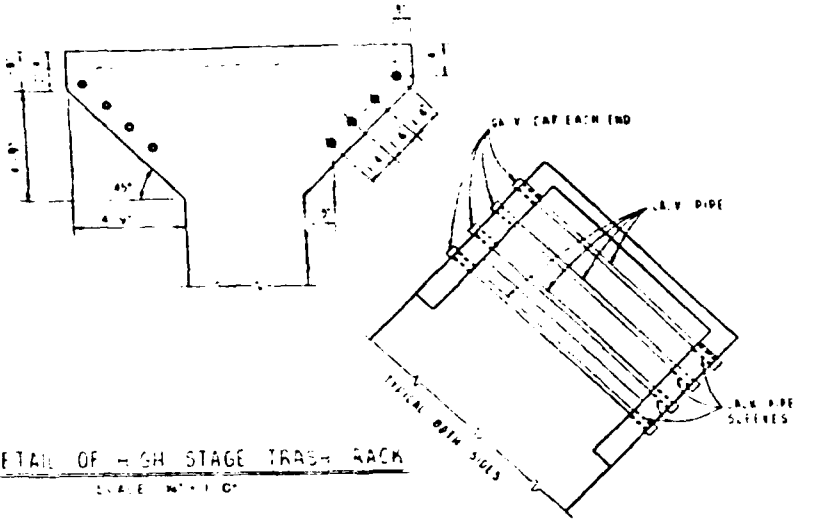
MAXIMUM CAMBER 0.30 FT. AT POINT "11"



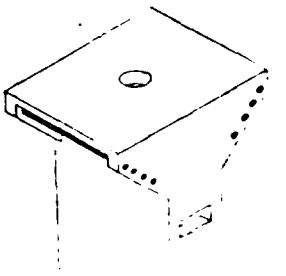


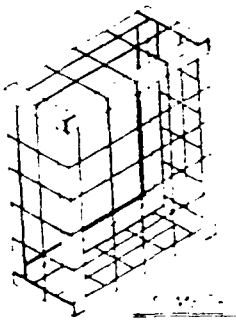
"AS BUILT"
DAM NO. 5 LEATHERWOOD CR.
LEATHERWOOD CREEK WATERSHED
HENRY COUNTY, VIRGINIA
SECTION THROUGH PRINCIPAL SPILLWAY
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
N. W. WILSON 3-62
PLATE 5
VA-473-P
ELEV. 753.5
ELEV. 760.5
INVERT ELEV. 753.0
15,300

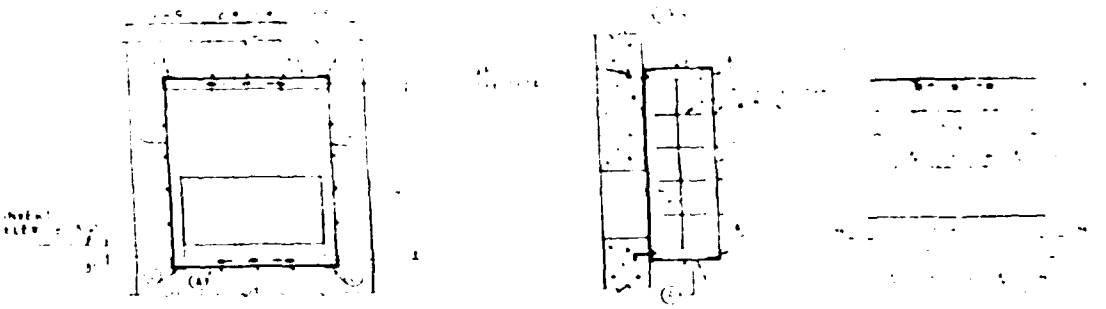
2



DETAIL OF HIGH STAGE TRASH RACK



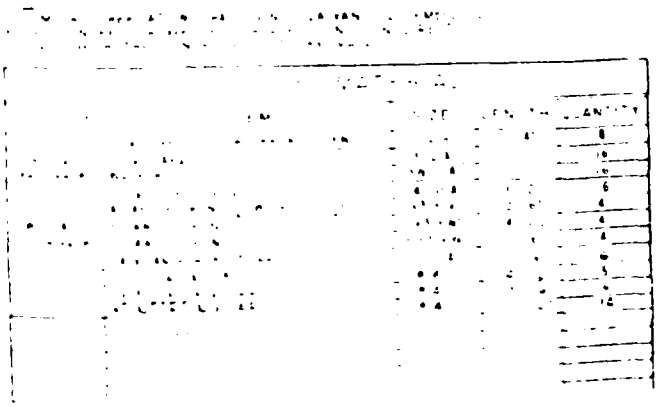




SECTION A-A

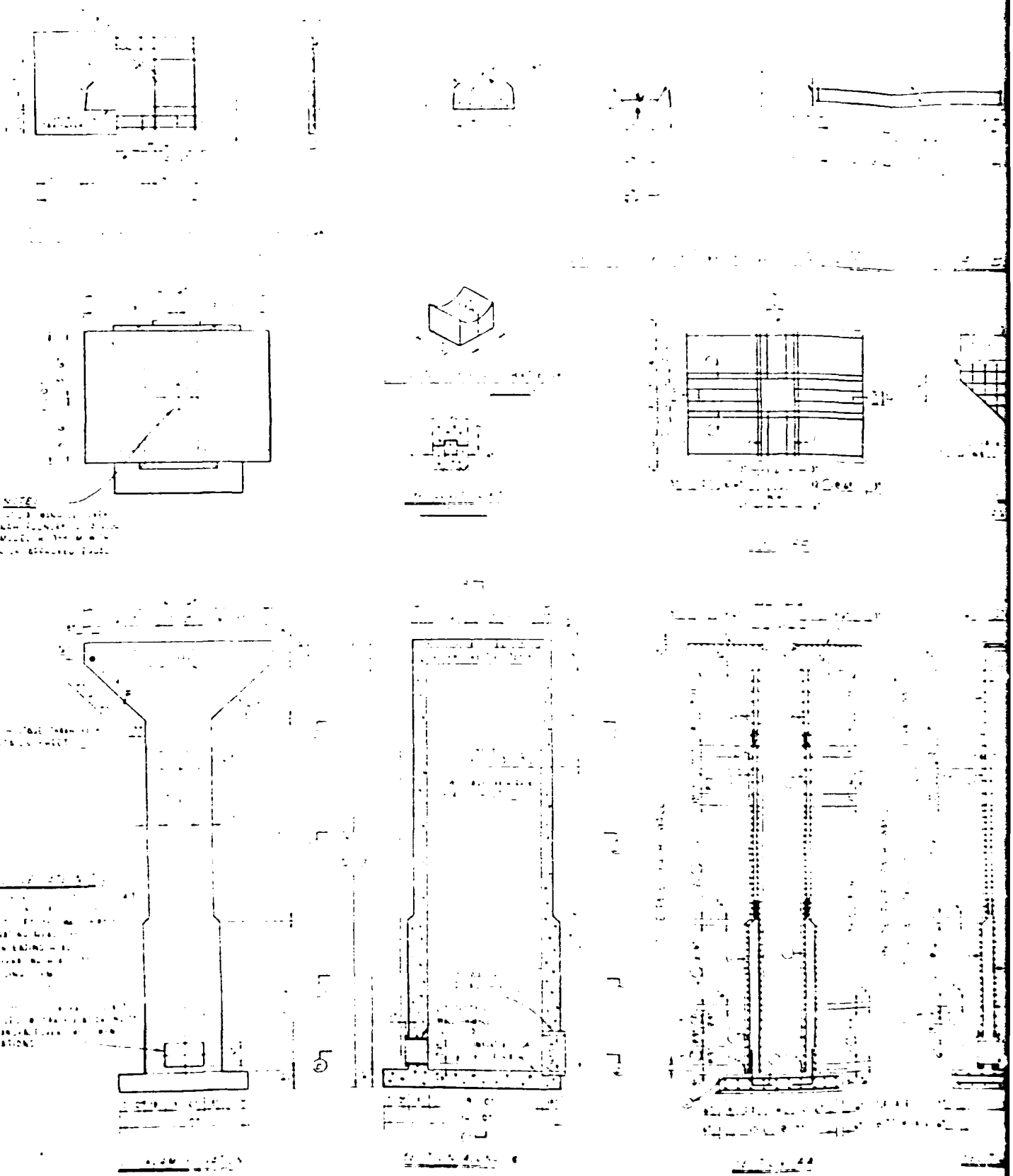
DETAIL OF REINFORCED
CONCRETE WATER PIPE JOINT

DETAIL OF WALL PIECE IN RISER

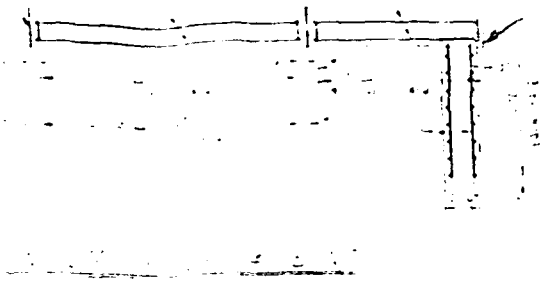


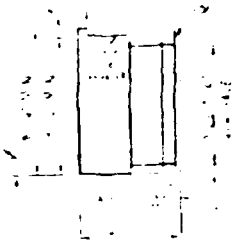
DAM NO 5 LEATHERWOOD CREEK
LEATHERWOOD CREEK WATERSHED
HENRY COUNTY, VIRGINIA
TRASH RACK AND MISC DETAILS

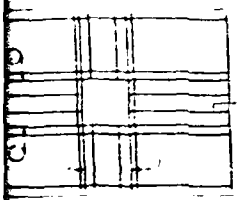
PLATE 6 VA-473-P

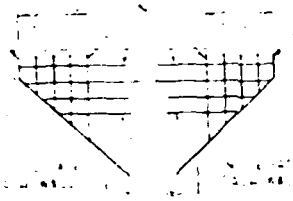


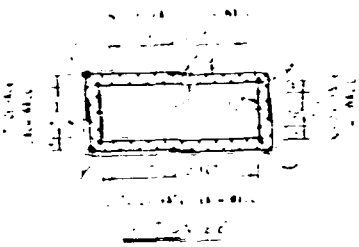
DETAILS OF REINFORCED CONCRETE PIER

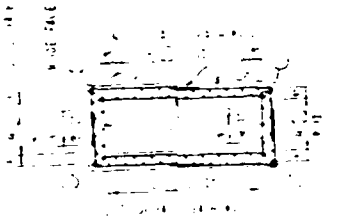


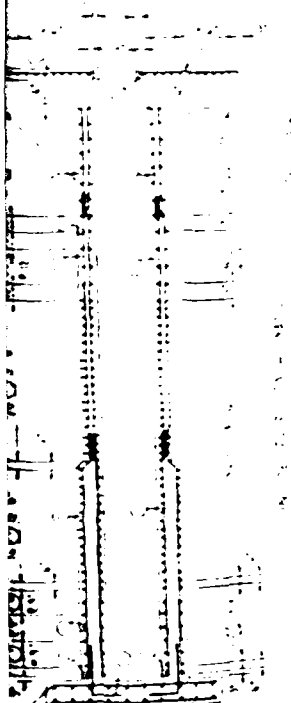


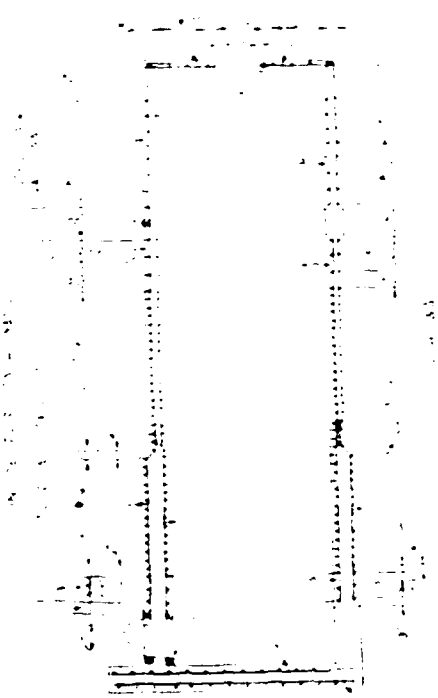


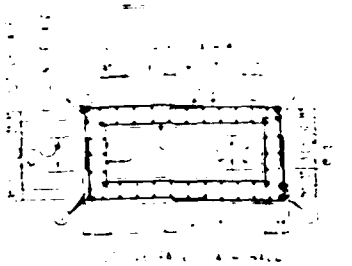


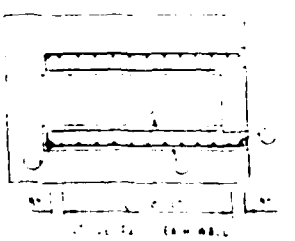


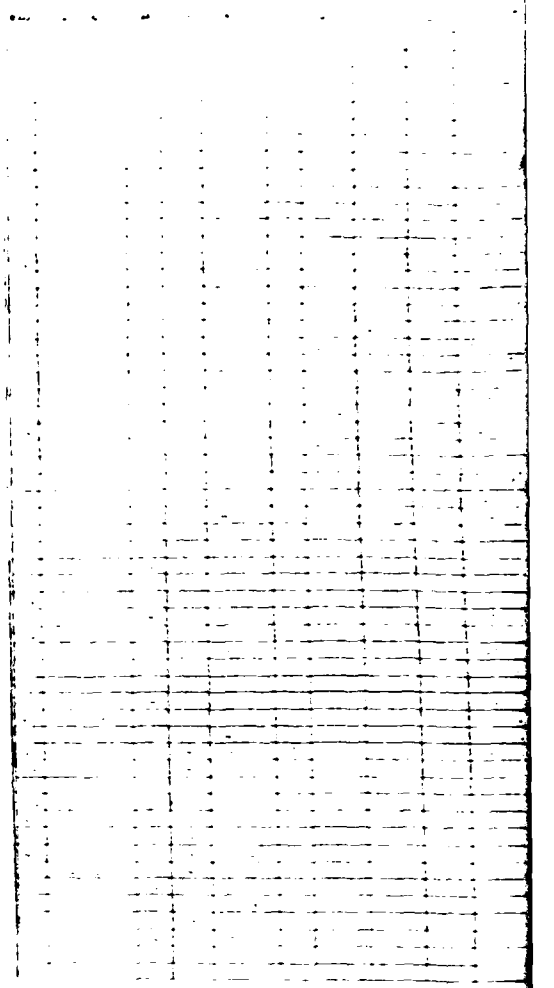


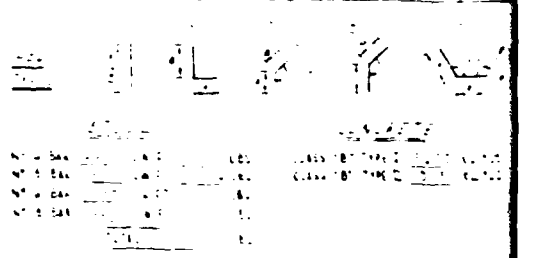












DAM NO 5 LEATHERWOOD CREEK
LEATHERWOOD CREEK WATERSHED
HENRY COUNTY, VIRGINIA
STRUCTURAL AND STEEL DETAILS

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

PLATE BUILT

VA - 473 - P

APPENDIX II

PHOTOGRAPHS

Photograph No. 1 - Upstream Slope

Photograph No. 2 - Downstream Slope

Photograph No. 3 - Intake Structure

Photograph No. 5 - Outlet Pipe and Plunge Pool

Photograph No. 5 - Emergency Spillway

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam Leatherwood No. 5 County Henry State Virginia Coordinates Lat 36°-43.9' Long 79°-43.4'

Date(s) Inspection June 30, 1981 Weather Cloudy Temperature 85°F

Pool Elevation at Time of Inspection 780.5 msl Tailwater at Time of Inspection 752 msl

Inspection Personnel:

Schnabel Engineering Associates, P.C.	J. K. Timmons & Associates	State Water Control Board
James J. Seli	Robert G. Roop, P.E.	Leon Musselwhite
Stephen G. Werner	Steve Oddi	
Raymond A. DeStephen, P.E.*		

Werner/Oddi - Recorders

* Not present during this inspection but visited the site on August 17, 1981

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	The slopes, crest and abutment contacts were inspected and no cracks were noted. Ground conditions were dry at the time of the inspection.	-
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movements were noted on the dam or beyond the downstream toe.	-
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The embankment crest has some minor rutting due to vehicular traffic, but the crest is essentially well grassed - no problem. Erosion was noted at the left downstream slope-abutment contact above the berm. This area should be corrected.	See Field Sketch
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The vertical and horizontal alignment of the dam appeared to be good. Field measurements indicate the embankment slopes are 2.5H:1V and the crest is 18 ft wide.	-
RIPRAP FAILURES	There was no riprap along the upstream slope at pool level. Riprap 1 to 4 ft± in length lines the plunge pool. The riprap appeared to be functioning properly and was in good condition.	-

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	The embankment ties in properly with the abutments. No erosion was observed along the contacts except in the left downstream slope.	See Field Sketch
ANY NOTICEABLE SEEPAGE	The downstream toe was dry and no seepage was observed. Some iron staining was noted around the plunge pool. This may not be related to seepage through the dam, but rather spring flow through iron bearing bedrock.	-
DRAINS	Two 6 inch CMP toe drains with two bars over the ends bound each side of the outlet pipe. There was no flow from the left pipe. Flow from the right pipe was clear, estimated at 2 gpm±.	-
MATERIALS	The embankment consists of fine sandy silt with mica, dry - red (ML)	-
VEGETATION	The embankment slopes are heavily vegetated with brush, briers, or blackberry bushes, honeysuckle and small trees 3 to 4 ft± high and less than 1 inch in diameter. Scattered cut trees (cedars and pines) generally less than 2 inches in diameter have been cut and left on the embankment slopes especially the downstream slope. Some small trees were also growing from the riprap gutters along the downstream slope.	The vegetation should be controlled. Observation was difficult.

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONTROL SECTIONS	Reinforced concrete riser type structure. Low level orifice and high level weir with trash rack.	No debris in trash rack. In good condition.
APPROACH CHANNEL	-	-
DISCHARGE CHANNEL	36 inch concrete pipe, invert 5 ft above channel. The plunge pool is lined with riprap which was intact.	Good condition
BRIDGE AND PIERS	-	-
EMERGENCY GATE	-	-
GATES AND OPERATION	Drain valve stem attached to top of operating spillway.	-

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	Grassed and well maintained. Two vehicle paths, one on the crest of the dam and the other across the EMS to the right side of the spillway. Cattle are allowed to graze in the emergency spillway, consequently there are several cattle paths. Several bare vehicular paths also exist.	
APPROACH CHANNEL	-	-
DISCHARGE CHANNEL	-	-
BRIDGE AND PIERS	-	-
MISCELLANEOUS	-	-

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
MONUMENTATION/SURVEYS	None	-
OBSERVATION WELLS	None	-
WEIRS	None	-
PIEZOMETERS	None	-
STAFFGAGES	None	Should be installed
OTHER	None	-

RESERVOIR

VISUAL EXAMINATION	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	Moderate to moderately steep wooded slopes (3H:1V$^{+}_{-}$) bound the reservoir. No shoreline erosion was noted. The reservoir area was free of debris.	-
SEDIMENTATION	The water was clear and no apparent sedimentation.	-

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Broad (300 ft±) floodplain with wooded side slopes. The side slopes range from moderate to moderately steep. A small meadow is located 350 ft right of the channel.	n = 0.05
	The channel is 20 ft± wide and 10 ft± deep. It is lined with dense trees and thick underbrush.	n = 0.05
SLOPES	Wooded slopes with dense underbrush; 3H:1V slopes.	n = 0.1
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 2 miles downstream there is a dwelling 20 ft± above the stream channel. About 5 miles downstream there are several dwellings 10 ft± above the stream channel and several commercial facilities 15 ft± above the channel.	Possible flooding could occur to the downstream dwellings.

CHECK LIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, OPERATION

ITEM		REMARKS
REGIONAL VICINITY MAP	Axton 7½ minute topographic map (U.S.G.S.)	-
DESIGN/CONSTRUCTION HISTORY	Designed by USDA, SCS constructed by Curtis S. Horton and completed in 1963.	-
PLAN OF DAM	See Appendix I	-
TYPICAL SECTIONS OF DAM	See Apppendix I	-
OUTLETS - PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	See Appendix I	-
SPILLWAY- PLAN SECTION DETAILS	See Appendix I	-
OPERATING EQUIPMENT - PLAN DETAILS	See Appendix I	-

ITEM		REMARKS
MONITORING SYSTEMS	None	-
RAINFALL/RESERVOIR HIGHPOOL RECORDS	None	-
GEOLOGY REPORTS	See Appendix IV and Reference 3, Appendix VI	-
BORROW SOURCES	See Appendix I	-
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY-FIELD TEST DATA	See Appendix I	-
HYDROLOGIC/HYDRAULIC DATA	Design data available at USDA, SCS Office in Richmond, Virginia	-

ITEM		REMARKS
DESIGN REPORTS	Summary included as Appendix IV. Complete design report available at USDA, SCS Office in Richmond, Virginia	-
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	Available at USDA, SCS Office in Richmond, Virginia	-
POST CONSTRUCTION ENGINEERING STUDIES RECORDS, SURVEYS	As built drawings included in Appendix I.	-
MODIFICATIONS	None	-
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None	-
MAINTENANCE OPERATION RECORDS	None	-

BY [illegible] DATE [illegible]

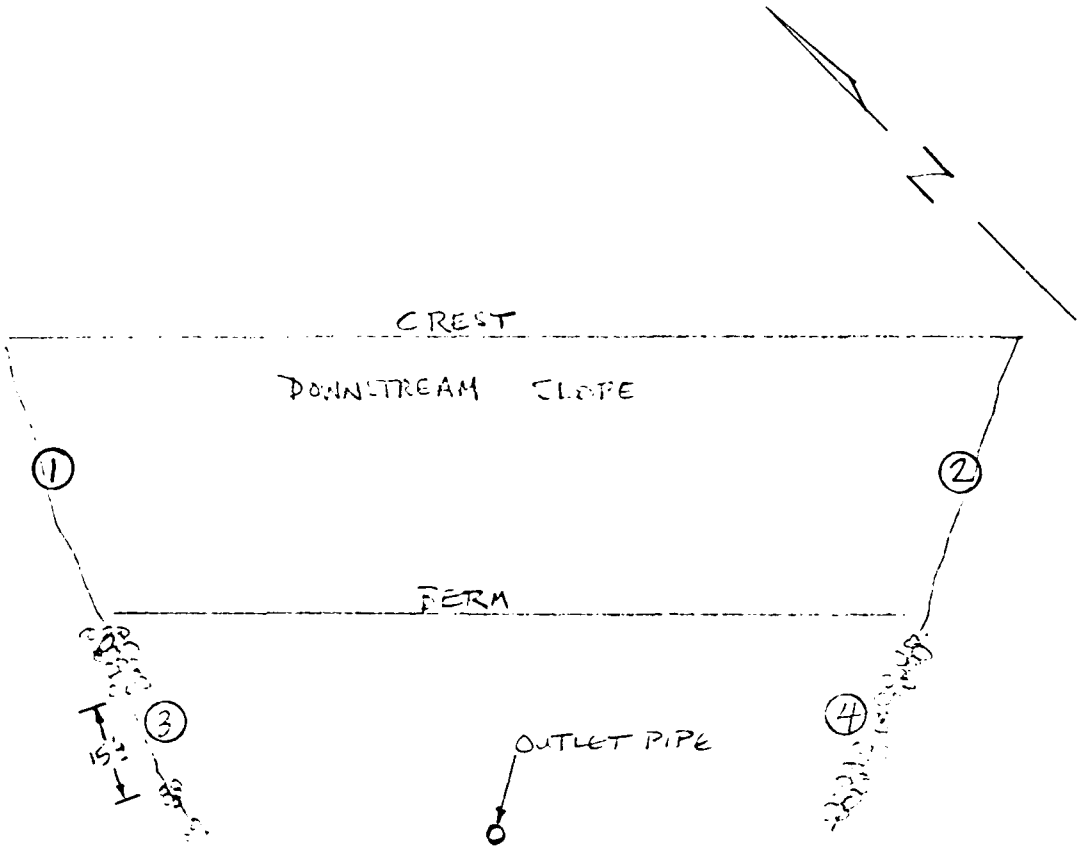
CONSULTING ENGINEERS

SHEET NO 1 OF 1

CHKD. BY ... DATE ...

JOB NO ...

SUBJECT EROSION ON DOWNSTREAM SLOPE - LOATHOP USED No. 5 DAM



NO SCALE

(1) RIGHT DOWNSTREAM ABUTMENT-SLOPE CONTACT IS WELL VEGETATED, NO EROSION NOTED.

(2) LEFT DOWNSTREAM ABUTMENT-SLOPE CONTACT HAS EXPERIENCED SOME EROSION DUE TO SURFACE RUNOFF. INCLUDES SCATTERED EROSIONAL NOTCHES 1-2 FT± WIDE AND 1-2 FT± DEEP. SOME SLOUGHING ALSO NOTED NEAR BERM-ABUTMENT CONTACT.

(3) DISPLACED RIPRAP OBSERVED BELOW THE BERM ALONG THE RIGHT DOWNSTREAM ABUTMENT-EMBANKMENT CONTACT. HAVE AN UPPER RIPRAP AREA 15 FT± WIDE AND 10 FT± LONG. RIPRAP IS 1-3 FT± LONG. THEN 15 FT± LONG AREA WITH NO RIPRAP. THEN SCATTERED RIPRAP BELOW.

(4) RIPRAP IS CONTINUOUS IN THIS AREA.

APPENDIX IV

DESIGN REPORT

DESIGN REPORT

[illegible] DAM NO. [illegible]
[illegible] CREEK, SITE #5
HENRY COUNTY, VIRGINIA

This site is located on [illegible] Creek, a tributary of Smith River, [illegible] miles [illegible] Martinsville, Henry, Virginia. A vicinity [illegible] the [illegible] U. S. Geological Survey Report, Virginia quadrangle.

This dam is classified as a class (c) structure according to criteria established in [illegible] TP-27.

The purpose of this structure is to provide watershed protection and will function with four other flood water retarding structures within the watershed.

The dam will control a watershed of 6,520 acres. It will be constructed of compacted earth fill controlled to a minimum of 95 percent standard proctor with a positive cutoff and a seepage drain in the downstream toe.

The principal spillway is to consist of a 36-inch inside diameter reinforced concrete water pipe and a two stage (3.0 feet x 9.0 feet inside dimensions) reinforced concrete riser.

An emergency spillway with a bottom width of 200 feet cut into natural earth in the west abutment will be used only when runoff exceeds 3.98 inches for a 6-hour duration storm.

The elevation of the sediment pool at 780.3 is based on the assumption that 235 acre-feet of sediment will accumulate in the normal pool area in 50 years. This elevation is also the crest of the orifice.

The flood routing procedure used in the design is described in Engineering Handbook, Section 5, Hydraulics, USDA, Soil Conservation Service. This flood routing procedure was used to determine the maximum stages shown in the following table:

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. VA-473-R SHEET 1 OF 4 DATE 7-20-62

Factor Which Determines Stage	Drainage Area Acres	Storage Ac.-Ft.	Runoff in Inches	Peak Inflow CFS	Peak Outflow CFS	Elev. Water Surface	Stage Controlled
50-year sediment	30.7	235	0.9	-	-	780.3	Crest of riser
5-year frequency moisture condition II	109.7	406	0.79	813	61	788.8	Crest of riser
100-year frequency moisture condition III	141.0	1966*	3.98	3279	193	804.2	Crest of emergency spillway
0.75x6-hour pt. rainfall moisture condition II	151.5	2195*	5.10	4545	1086	805.8	Design high water
1.25x6-hour pt. rainfall moisture condition II	170.5	2745*	10.29	8542	6305	809.2	Top of dam

* Sediment not included.

The top of dam (elevation 809.2) provides a freeboard of 3.4 feet above design high water.

The peak discharge of the principal spillway at the crest of the emergency spillway is 193 c.f.s. The time required to empty the pool between the crest of the emergency spillway and the sediment pool elevation would be 6.29 days.

The peak discharge for the emergency spillway for the design storm is 1086 c.f.s. with a maximum velocity of 6.80 feet per second. The duration of flow through the emergency spillway for this storm would be 13.36 hours.

The geology report and the Soil Mechanics Laboratory report were used in the design and are attached.

The following guides by the USDA, Soil Conservation Service, were used in the design of this structure:

DESIGN REPORT

Hydraulics Handbook, section 5
Structural Design Handbook, section 6
Hydrology Handbook, section 4
Technical Releases Nos. 2, 5 and 10

Copies of Engineering Handbooks and other publications used in this design may be obtained from Mr. Tom F. McGourin, State Conservationist, USDA, Soil Conservation Service, Richmond, Virginia.

Concurred:

R. C. Barnes, Jr.
State Conservation Engineer

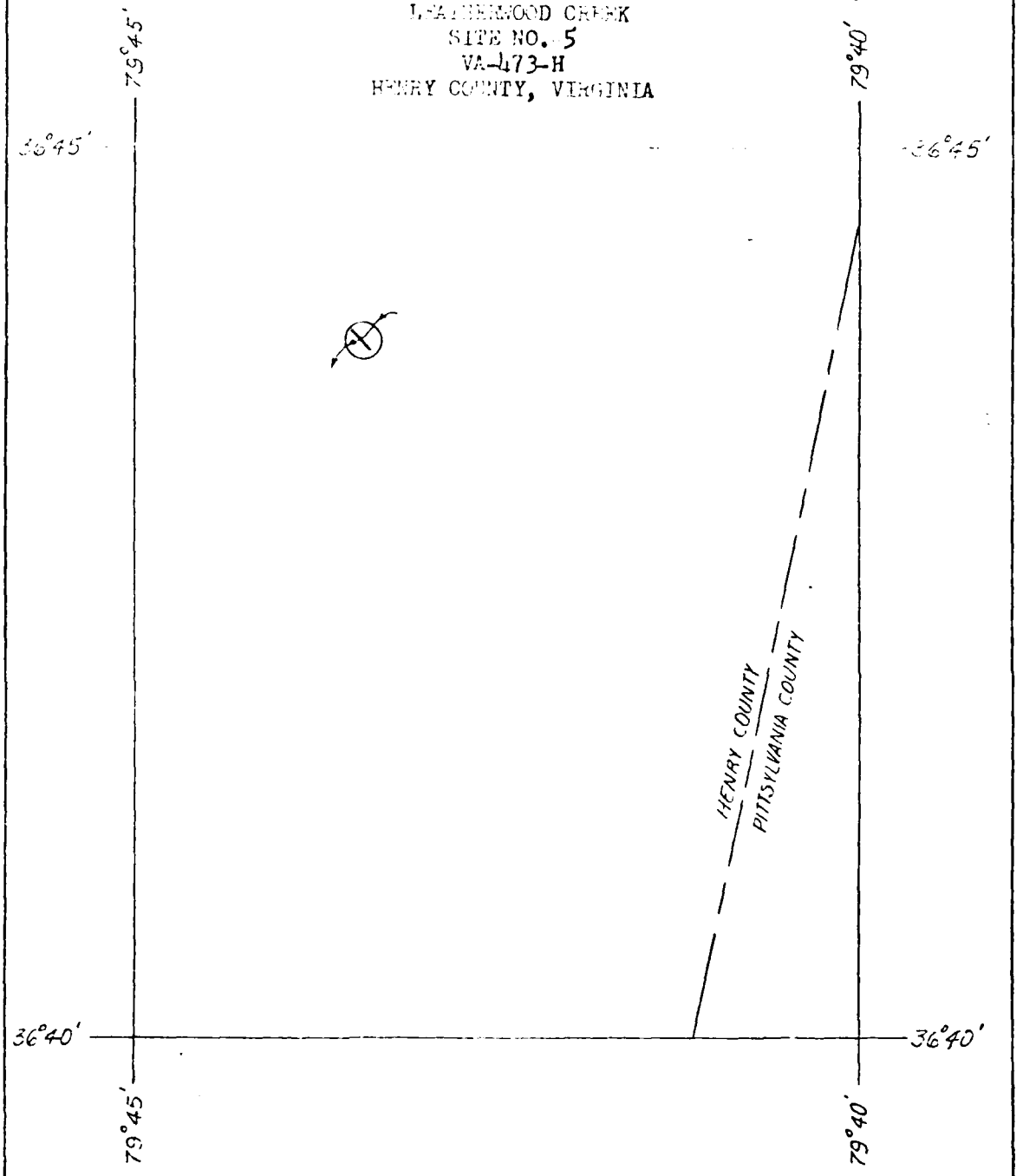
Gerald E. Oman
Design Engineer

Vincent McKeever
Hydrologist

Robert F. Fonner
Geologist

REFERENCE:	U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE ENGINEERING & WATERSHED PLANNING UNIT UPPER DARBY, PENNSYLVANIA	DRAWING NO. VA-473-R SHEET 3 OF 4 DATE 7-20-62

LEATHERWOOD CREEK WATERSHED FLOOD PREVENTION PROJECT
LEATHERWOOD CREEK
SITE NO. 5
VA-473-H
HENRY COUNTY, VIRGINIA



REFERENCE	U.S DEPARTMENT OF AGRICULTURE	DRAWING NO
DRAPER, VA. N.C. 15' QUAD	SOIL CONSERVATION SERVICE	SHEET ... OF ... DATE ...

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

GENERAL

State Virginia County Henry Feathered Creek

Investigated by (signature and title) L. A. Gorman, Geologist

SITE DATA

Drainage area size 10.19 sq. mi. 6522 acres. Type of structure Earth Fill Purpose Flood Prevention

Direction of valley trend (downstream) Southeast Maximum height of fill 49.6 feet. Length of fill 560 feet

Estimated volume of compacted fill required 74,580 yards

STORAGE ALLOCATION

	Volume (ac. ft.)	Surface Area (acres)	Depth at Dam (feet)
Sediment	252	27	26
Floodwater	2140	180	50

SURFACE GEOLOGY AND PHYSIOGRAPHY

Physiographic description Piedmont Physiographic Prov. Topography Rolling Attitude of beds: Dip Strike

Steepness of abutments Left 20 percent, Right 30 percent. Width of floodplain at centerline of dam 150 feet

General geology of site: The site is located in the Piedmont Physiographic Province in an area underlain by the Leatherwood Granite* of Precambrian age. This granite was intruded into the Wissahickon schist so consequently in many places these two rocks are so mixed up as to form what appears to be an interbedding of granite and a gneiss-schist complex. The weathering is deep in places but the structure of the bedrock remains. In the test pits the material appears to be bedrock but it excavates like compact cemented silty sand. The mineral constituents of the granite gneiss-schist complex are quartz, feldspar, muscovite, biotite and some dark minerals probably hornblende. In places the granite is quite coarse and looks like apegmatite.

*Bulletin 33, Pegmatite Deposits of Virginia, A.A. Pegau, VGS, 1932.

VA-473-G

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

FEATURE Centerline of Dam, Principal Spillway, Emergency Spillway, and Borrow Area
(Centerline of Dam, Principal Spillway, Emergency Spillway, the Stream Channel, Investigations for Drainage of Structure, Borrow Area, Reservoir Basin, etc.)

DRILLING PROGRAM

Equipment Used	Number of Holes		Number of Samples Taken		
	Exploration	Sampling	Undisturbed (state type)	Disturbed Large	Disturbed Small
Case Tractor mounted backhoe	26			12	3
Total	26			12	3

SUMMARY OF FINDINGS
(include only factual data)

Centerline:

The centerline is characterized by shallow soils above a layer of weathered bedrock. The left abutment is fairly steep and has hard bedrock outcropping at the base and up part of the 30 percent slope, the upper slope near the top of the dam has a very thin soil mantle over weathered granite. The flood plain is covered by a layer of fine silty to poorly sorted sand and thin lenses of coarse sand to fine gravel. The bedrock ranged in depth from 0 to more than ten feet in places. The silty sand is the weathered product of the Leatherwood granite. The right abutment is characterized by a layer of soil over weathered granite-gneiss-schist complex. All abutment holes were dry and well drained. Where bedrock was encountered it appeared to be tight with no joints or open fractures present.

The channel at the centerline is quite wide and deep with a layer of sand and gravel 3 - 5 feet deep over granite-gneiss. The channel appears to be about in equilibrium or possible aggrading slightly.

Spillways:

The foundation conditions present in the principal spillway area are very irregular. The depths to bedrock range from the surface at the centerline TP-303, to 10 feet upstream under the riser, TP-305, to below 13 feet at the outlet end in TP-301. It will probably be necessary to excavate some rock to get a uniform grade under the conduit.

Three samples were taken for gradational purposes for the design of foundation drains.

Spillways - Continued

The emergency spillway is to be located in a draw beyond a hill in the right abutment. The material found in the test pits consisted mainly of silty sand (SM) with minor amounts of sandy silt (ML) and silty gravel (GM) present. This silty sand is the weathered product of granite-gneiss-and schist. All rock encountered in these holes was deeply weathered so no rock excavation should be anticipated. All test pits dug in this area were dry and all materials were well drained.

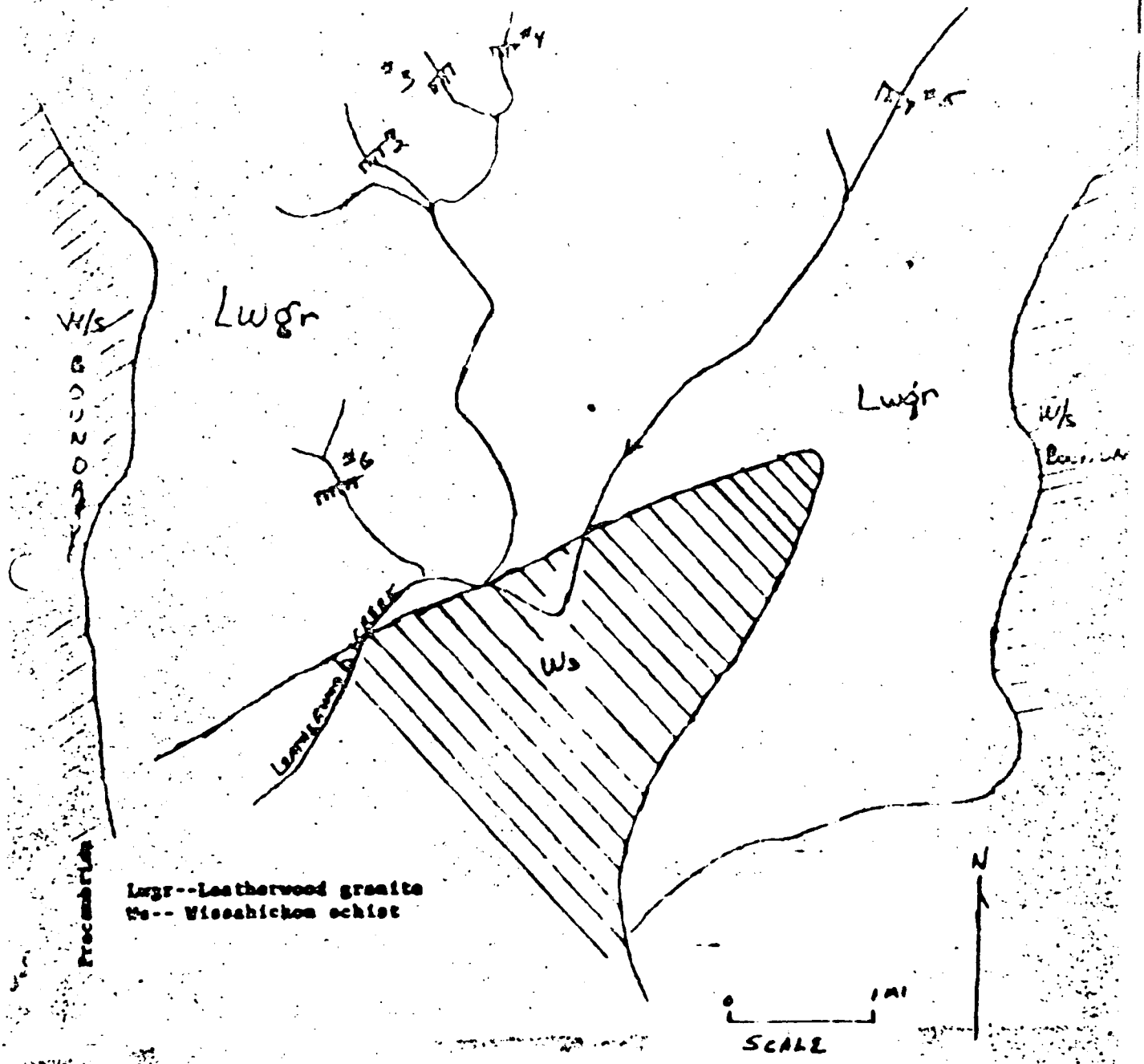
Borrow Area:

Three areas are to be utilized for borrow: the emergency spillway, the area adjacent to the top of the dam in the left abutment, and an area in the draw approaching the emergency spillway. The materials encountered in all three areas are similar. The material is mostly silty sand but some sandy silt and minor amounts of silty gravel are also present.

Some additional borrow is available from the flood plain but because of the unevenness of the bedrock and the unpredictability of the flood plain material it may be better to confine the borrowing to areas above the flood plain.

Concurred by:

R. C. Barnes
State Conservation Engineer


Lwgr
Lwgr
Ws
Lwgr--Leatherwood granite
Ws-- Wesahickon schist
Precambrian
N
1MI
SCALE

12-59

DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State Virginia County Henry Watershed Leatherwood Cr. Subwatershed

Site number 5 Site group I Structure class a Investigated by L.A. Gorman (signature and title) Date 2/19-21/62

L.A. Gorman, Geologist

INTERPRETATIONS AND CONCLUSIONS

FOR IN-SERVICE USE ONLY

1. Abutment foundation conditions are very adequate. Hard or firm bedrock was found in all abutment holes. Some of the rock was deeply weathered but in all cases readings of greater than 2.5 tons per square foot were found when the pocket penetrometer was used. All holes were dry and the material was well drained.

2. The foundation conditions for the principal spillway are quite irregular. The riser end represented by TP-304 and 305 shows bedrock at 12 and 10 feet respectively. In the center section represented by TP-303 bedrock is at the surface and in the outlet end represented by TP-301 and 302 no bedrock was found at 13 feet. From these findings it would appear that some rock excavation will be necessary to get a uniform grade for the conduit.

3. An impermeable core should be installed to control seepage through and under the dam.

4. Some type of foundation drainage should be installed but because of the permeabili of the flood plain as evidenced by samples 301, 501 and 502 some use may be made of the local material such as the stream gravel in Sample 401.

5. No bedrock excavation should be expected in the emergency spillway. Weathered bedrock was encountered in all holes so the possibility exists that so resistant ribs may be found but the backhoe used had no difficulty excavating to the limits.

6. Sufficient borrow is available at the site. The borrow areas are located well above flood plain levels so no drainage is necessary. Some borrow may be obtained from the flood plain but because of the unpredictability of this area any borrowin from this area should be kept to a minimum.

7. Care will have to be taken not to disturb the two cemeteries located within the construction area.

Concurred by:

R. C. Barnes
State Conservation Engineer

VA-473-G

APPENDIX V

STABILITY DATA

G. C. Bruce

TO : W. D. Barnes, State Conservation Engineer, DATE: June 11, 1962
SCS, Richmond, Virginia

FROM : Roy S. Decker, Head, Soil Mechanics
Laboratory, SCS, Lincoln, Nebraska

SUBJECT: Virginia WP-2, Leatherwood Creek, Site No. 5

ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 4 sheets.
2. Consolidation Data, 1 Test, 2 sheets.
3. Form SCS 355, Triaxial Shear Test Data, 6 sheets.
4. Form SCS 352, Compaction and Penetration Resistance Report, 11 sheets.
5. Form SCS 353, Filter Material, 1 sheet.
6. Form SCS 357, Summary - Slope Stability Analysis, 1 sheet.
7. Form SCS 372, Recommended Use of Excavated Material, 1 sheet.
8. Geological Plans and Profiles (These will be mailed June 12, 1962 in a separate envelope.)

INTERPRETATION AND DISCUSSION OF DATA

FOUNDATION MATERIALS:

A. Classification: The foundation in the flood plain consists of some 4' to 6' of reworked materials, but is largely residual from deeply weathered gneiss below 6'. The materials classify mostly as SMs with 9 to 43% fines. The clay size fines show a high degree of dispersion.

The firm bedrock was found from near surface to as deep as 20 feet in TH # 302. Some weathering was noted in both abutments.

B. Undisturbed Samples: Two undisturbed samples were submitted from TH # 302. The shallower Sample 62W3516 from 3' to 5' had an overall dry unit weight of 1.27 gm/cc. Shear and consolidation specimens varied from 1.15 gm/cc to 1.39 gm/cc. Shear specimens from Sample 62W3517, taken from 9' to 11', had a dry unit weight averaging 1.72 gm/cc. Stratification was notable in both samples.

C. Penetration Resistance: Blow count agrees with the densities found in undisturbed samples. The counts varied from 1 to 6 blows per foot for the surface 10' and ran from 8 to 200 below 10'.

D. Permeability: Permeability tests were made on both undisturbed samples. The tests cried during consolidation on 62W3516 piped. Vertical permeability rates obtained were k = 14.3 ft./day for the coarse SM of low density and k = 0.07 ft./day for the dense fine SM.

Based on the stratification and grain size distribution shown for samples submitted, overall rates should be moderate. Some seepage is to be expected through all weathered bedrock.

E. Consolidation: One consolidation test was made on Sample 62W3516. The specimen tested was an SM-SP. A potential of .032 ft./ft. was indicated under the load of this structure. Since most of the materials are finer, a potential of 4% has been assumed for the surface 10'.

F. Shear Strength: Both undisturbed samples were tested. Consolidated, undrained triaxial tests were made on fine portions of both 62W3516 and 62W3517, and a direct shear test was made on the coarse portion of 62W3516. Results are as follows:

Sample No.	Type Test	Wet Density gm/cc	$\phi°$	c p.s.f.	Strain at Failure %
62W3516 T	Triaxial	1.24	19°	800	8
62W3516 B	Direct	1.15	25.5°	100	5
62W3517	Triaxial	1.72	29°	950	10

EMBANKMENT MATERIALS:

A. Classification: Borrow samples were submitted from the emergency spillway, from the slope opposite the entrance to the spillway and from the left abutment.

Samples from the emergency spillway classed as SM, ML and MH. There is 20,000 cubic yards total, but no indication as to how much of each.

Test areas from the spillway classed as MH and SM with a total of 25,000 cubic yards, but with no breakdown as to amount of each class of material.

The samples from the right abutment also class as SM and MH, and no breakdown is available. The total available is 10,000 cubic yards.

B. Compacted Densities: Standard Proctor compaction produced maximum dry densities of 94.5 p.c.f. to 103.5 p.c.f. for the SMs, 100.0 p.c.f. for the ML and 85.5 p.c.f. to 93.5 p.c.f. for the MH. All materials are micaceous to a variable degree.

C. Shear Strength: Consolidated, undrained triaxial shear tests were made on two SMs and an MH. The specimens were compacted to 95% of Standard density and soaked before testing. Total stress shear values obtained were as follows: 62W3195, SM, -- ϕ = 28°, c = 450 p.s.f.; 62W3201, MH, -- ϕ = 14.5°, c = 1025 p.s.f.; and 62W3203, SM, -- ϕ = 22.5°, c = 500 p.s.f.

SLOPE STABILITY ANALYSIS:

Stability of embankment slope was checked by a Swedish Circle Method. Safety factors of 1.40 are indicated for full drawdown on the 2 1/2:1/3:1 upstream slope and 1.47 for steady seepage on the 2 1/2:1 downstream slope.

Strength shown by shear tests on the foundation indicate failure would not occur over the foundation if low density surface material is removed.

RECOMMENDATIONS

A. Site Preparation: In addition to normal stripping, all low density surface materials should be excavated and replaced as compact fill. Material below 77.0 p.c.f. on a dry weight basis should be removed in this operation.

B. Cutoff: A cutoff to firm rock is recommended. Backfill with MH placed at D-2 (95% of Standard) density.

C. Principal Spillway: The location proposed at ℄ Station 1+90 is satisfactory from a foundation standpoint. If a location near ℄ Station 2+20 could be found so the pipe could be set on a rock foundation, it would seem more desirable.

The conduit trench should be bottomed on firm rock.

Backfill with CL or SM like 6W9194 or 6W9210 placed at 100% of Standard density.

About 3% settlement should be expected under the centerline fill material placed at this density. The consolidation potential is 3.2%. For 30' of fill under the pipe, a camber of 0.9' would be desirable.

Based on b = 330', h = 57' and d = 10', a maximum horizontal unit strain of 0.0035 ft./ft. is indicated. Pipe joint design should be based on this value unless the concrete base is set on rock.

It is recommended that pipe strength design be based on a ϕ angle of 30°.

D. Drainage: A trench drain at c/c = 0.4 is recommended to control the phreatic line and relieve pressures from seepage through the partially weathered rock. In depth, it should extend down into the weathered rock. It should extend the full lengths of the upstream toe excavation in a blind trench. A perforated pipe outlet should extend across the flood plain from ℄ Station 2+70 to 3+30.

Filter limits to fit the variable bases concerned are shown on SCS ⌀ 353. The limits are narrow.

The SP available on the site, represented by Sample 6W9192, has too many fines below ⌀ 10 screen size. If a wide trench is used and the material is only lightly compacted, it may provide sufficient relief to the stratified foundation. As an alternative, the SP could be re-screened to provide the desirable gradation.

Subj: [illegible], Site No. 5

4. [illegible]: [illegible]

1. [illegible]

2. [illegible]

3. [illegible]:

[illegible]: [illegible]

[illegible]: [illegible]

4. Provide [illegible]

Prepared by:

[illegible]

[illegible]

By: [illegible]

[illegible]

[illegible] 557
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State: *Virginia* Project: *Leatherwood Creek Site #5*

Date: *5-21-62* Analysis Made By: *G.M.G.* Checked By: *R.E.K.*

Method of Analysis: *Swedish Circle*

Location of Material	Found	Emb 05% Std	Emb 95% Std	Emb 95% Std	Found
	SM	SM	MH	SM	SM
Sample No.	62W3516	62W3195	62W3201	62W3203	62W3517
γ_d	115	100.0	88.2	108	107.5
γ_m		110.0	105.0	120	
γ_s	110.5	123.5	114.0	1205	130.5
γ_b	48.0	62.0	51.5	30	68.5

Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		19.0°		28.0°		14.5°		22.5°		29°
Tan ϕ				0.532		0.259		0.414		
K										
C		500		450		1025		300		950

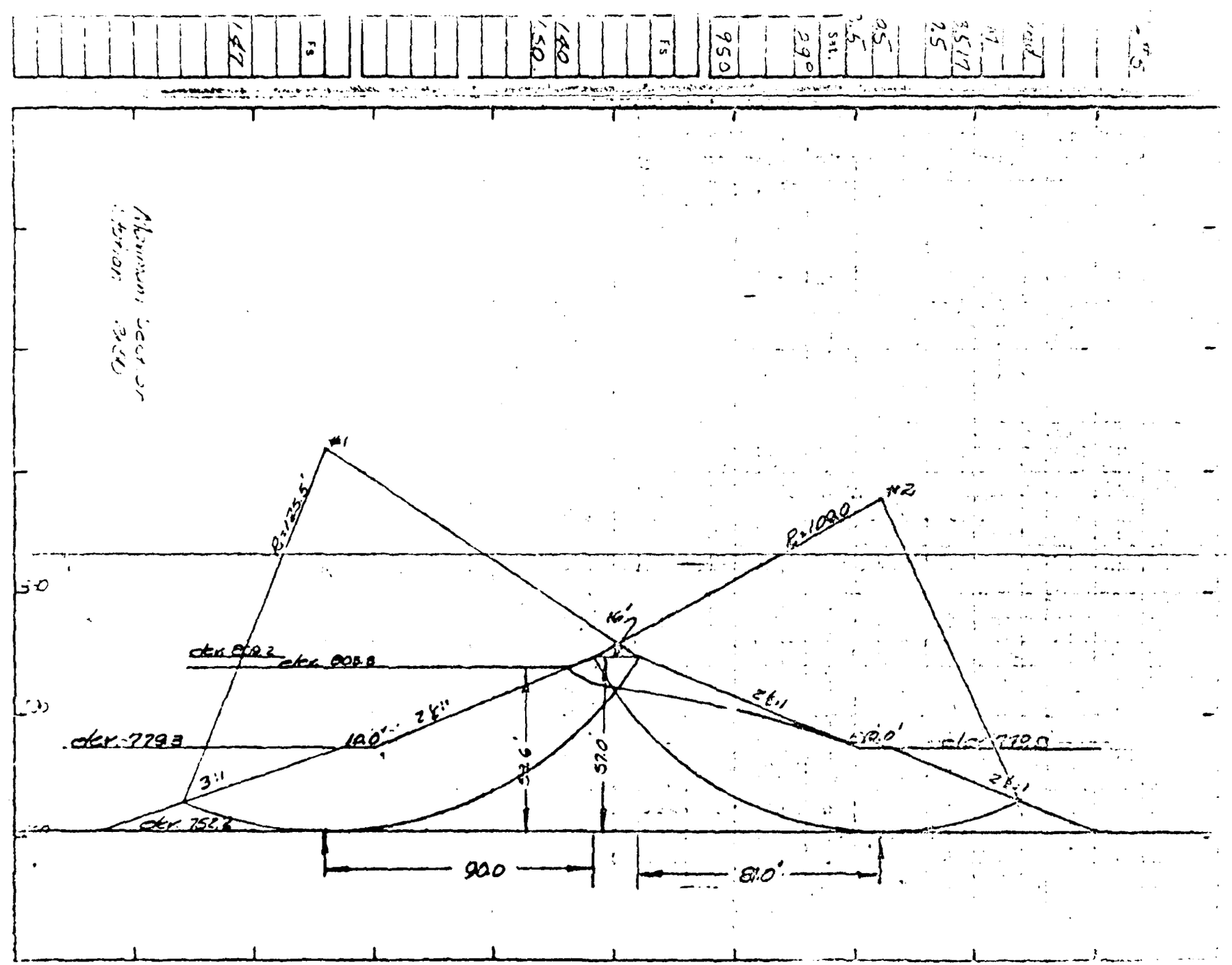
Margin notes: 3203 / 110 / 103.5 / 46 / 25.5° / 100

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
1	3½:1	Full drawdown - 10.0' berm @ elev. 773.3 Arc cut from downstream shoulder thru Emb 62W3203 only. Sat. shear values only	1.40
1a	3½:1	Same as #1 but Emb 62W3195.	1.50

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
2	4:1	No drain - 10.0' berm @ elev. 779.3. Arc cut from upstream shoulder thru Emb 62W 3203 only. Sat. shear values only	1.47


#1
#2
R=1235'
R=1090'
dkr. 802.2
dkr. 808.8
dkr. 729.3
dkr. 752.2
10.0'
2½"
3:1
2½:1
92.6'
52.0'
90.0'
81.0'

APPENDIX VI - REFERENCES

1. Recommended Guidelines for Safety Inspection of Dams, Department of Army, Office of the Chief of Engineers, 46 pp.
2. Design of Small Dams, U. S. Department of Interior, Bureau of Reclamation, 1974, 816 pp.
3. Geology of The Axton and Northeast Eden Quadrangles, Virginia, by Van Price and others, Virginia Division of Mineral Resources, Publication 22.
4. HEC-1 Dam Break Version, Flood Hydrograph Package, Users Manual for Dam Safety Investigations, the Hydrologic Engineering Center, U. S. Army Corps of Engineers, September, 1978.
5. Hydrometerological Report No. 33, U. S. Department of Commerce, Weather Bureau, U. S. Department of Army, Corps of Engineers, Washington, D. C., April, 1956.
6. Technical Paper No. 40, U. S. Department of Commerce, Weather Bureau, Washington, D. C., May, 1961.


FILMED
8